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THESIS - MASTER OF PHILOSOPHY

THE OPEN UNIVERSITY - FACULTY OF TECHNOLOGY

SYSTEMS DEPARTMENT

FARMERS ACTIONS AND ATTITUDES WITH RESPECT TO  
AGRICULTURAL POLLUTION

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Abstract  
Farmers Actions and Attitudes with respect  
to agricultural pollution

Research has been undertaken by me to establish farmer attitudes and actions regarding control of livestock wastes and associated pollution problems.

Little research has been attempted in this area, despite new legislation being imposed on the farming community.

The aim of my study was to establish by a series of interviews and questionnaires, with a random selection of farmers, their opinions and levels of knowledge in respect of environmental topics such as:- legislation, pollution, financial and information sources.

From my research a number of important issues have been detailed that should assist regulatory authorities such as MAFF and NRA, to work more effectively with the agricultural community, in controlling pollution arising from livestock wastes.

Enforcement of legislation pertaining to agricultural wastes is rigorously enforced in UK yet little information exists as to the expected improved river water quality that should result. Farmers have indicated to me that continuation of the grant for effluent control schemes is crucial, if their co-operation and financial viability is to be maintained in this area of environmental improvement.

The approach by the authorities to farmers has been demonstrated to be fragmented and contradictory. Although they utilise some formal advice, it is the articles in agricultural journals that are frequently used to provide detail on new legislation and practical requirements. It has been found that such articles are generally technically accurate and are seasonal, to represent current problems.

Some evidence has been found that authorities do not always apply regulatory requirements in an even and correct manner. Lack of training and detailed guidelines is evident from my research and there is a need to address these concerns. The authorities must consider the cost benefits for the environment question, to sustain a strategy, that has cost significant sums to individual farmers and the tax payer.

The attitudes of most farmers approached was positive in respect of environmental matters and little difference was detected between the groups of active and non-environmentalists. Many of the livestock farmers undertook remedial work at their own instigation when pollution occurred, with NRA insistence being in the minority.

It has found however that number of farm pollution incidents are now beginning to decrease on an annual basis, due to a number of interrelated factors. A more effective working relationship between all parties involved is necessary, if a sustained improvement in river water quality is to be achieved on a consistent basis.

## **SUMMARY**

**Minimal information appears to exist regarding the influences that affect farmers actions with respect to farm waste control matters.**

**A series of oral and written surveys was undertaken with a random cross section of East Anglian farmers to obtain a representative view of their attitudes, actions and depth of knowledge.**

**The survey findings suggest that a majority of farmers anticipate conforming with all regulations pertinent to farm waste control. At the present time however no evidence exists from the regulatory authorities that substantial improvements in river water quality are occurring. The cost benefits in respect of farmers/environment have yet to be quantified.**

**Information sources such as agricultural journals are a very important way of effectively passing detail to farmers.**

**Contrary and competitive attitudes are apparent between governmental departments involved in agricultural issues.**

**Farmers believe that grant aid for farm effluent schemes may be a necessity if marginal sectors of farming are not to become economically unviable.**

Training of staff involved with farm waste regulation is minimal and an uncoordinated approach to farm pollution control currently exists within the regulatory authorities. Implementation of catchment pollution prevention initiatives, together with the introduction of farm waste plans would be a positive improvement.

Although the UK farmers are for the majority capable of controlling farm effluent, the limited development of any alternative treatment arrangements will mean that, river pollution will continue to occur on a occasional basis from existing containment and disposal system malfunctions.

### **Terms of Reference and Objectives**

1. To establish the principle factors that influence attitudes and actions in the farming community.
2. To examine pollution statistics and determine associations between critical factors.
3. To put forward recommendations for improvements in farm pollution control.



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## **CHAPTER 1                      BACKGROUND AND LITERATURE REVIEW**

### **1.1     Introduction**

The aim of this research was to establish which factors and influences are important in the control and management of farm wastes by the farming community. If these can be determined, then it may be possible to devise actions that can be accurately and more effectively disseminated by the authorities and industry. This could result in a reduction in number of farm pollution incidents, since more germane advice could result in remedial actions being taken before problems develop.

Data on farm pollution incidents has been produced, (MAFF/NRA 1989) yet little detailed research has been undertaken into the fundamental causes. It is believed that although some talented officers from organisations such as NRA and ADAS can effect change and improvements by personal dialogue with farmers, many governmental initiatives do not achieve their aim satisfactorily.

If factors could be identified that had a major influence on the incidence of farm effluent problems then it would also be necessary to identify the most effective communication channel to farmers, for them subsequently to act on.

Farmers in the United Kingdom are reputedly stubborn at changing their ways yet they have recently had detailed farm regulations imposed on them (Robertson 1977). What is not clear is if they had gained prior detailed



knowledge of these regulations and if they anticipated problems complying with them.

Much research had gone into developing improved systems of farm effluent control and treatment, (Bascombe et al 1990) but little investigation has been undertaken into improving communication with farmers (Mainstone et al 1991). There had been a failure to control farm effluent pollution resulting from expansion of intensive livestock enterprises, with a consequent 179% increase in incidents between 1979 and 1989 (MAFF 1985-A). Although only 2% of the farms in England and Wales were involved in these pollution incidents, 36% of major river pollution incidents in 1990 originated from farms, a significant proportion (NRA 1992).

## **1.2 The effect of Agriculture on the Environment**

### **1.2.1 Changes and developments since 1947**

Intensive farming in Britain has developed as a result of government policies over the last fifty years. Emphasis has been on increasing output through the use of subsidies, financial incentives (NFU 1984) and through the support of extensive agricultural research programmes to make the country as self sufficient in foodstuffs as possible (NFU 1984). The farming community responded to these initiatives by specialising and increased intensity of production. Firstly increased herd size for dairy cattle and pigs resulted in greater effluent generation, as housing in buildings became the "*norm*"

(MAFF/NRA 1989). In parallel with this trend was the practice of ploughing up permanent pasture for arable crops and the use of artificial fertilizers. Since pasture or fallow land was traditionally used for manure and effluent spreading, a problem then existed in finding sufficient area of land to dispose of the growing amount of effluent. Application of effluent at high rates on to arable crops grown on heavy soils, then began to result in pollution incidents and watercourse contamination (MAFF/NRA 1989). A number of farms also specialised to the extent that they had minimal acreage and intensive livestock units (Milford 1987). At these sites inadequate disposal arrangements did not hinder the development of highly profitable farming enterprises and frequently pollution problems only arose once the farm was developed to its full potential.

#### **1.2.2 Environmental change and agriculture**

Since the Second World War the implementation of new agricultural policies has resulted in many changes not directly associated with food production. Landscape change connected with the development of intensive cereal farming is particularly apparent in East Anglia (Marsden 1990). Field sizes have been significantly enlarged with consequence loss of hedgerows and ditches. This major change in landscape then impacts on the established ecological patterns. For example, plants, birds and animals that require the traditional meadows with boundary hedges have had habitats eroded with potential affects on population (Carr & Tait 1989). It is also the use of marginal agricultural land for cereal production that has had considerable impact on wildlife. Examples

of this land would be watermeadows, heathlands, rough pasture and reclaimed woodland.

These changes have indirectly affected water quality and will continue to do so since the natural nitrogen cycle within established farmland has been considerably changed (Payne 1989). The subsequent annual applications of nitrate and phosphate to cereal land may lead to considerable losses of this material into watercourses via modern field land drainage systems (Addiscott & Bland 1988). Eutrophication of inland rivers is the subsequent effect with possible drinking water health hazards from elevated nitrate concentrations (DoE 1988).

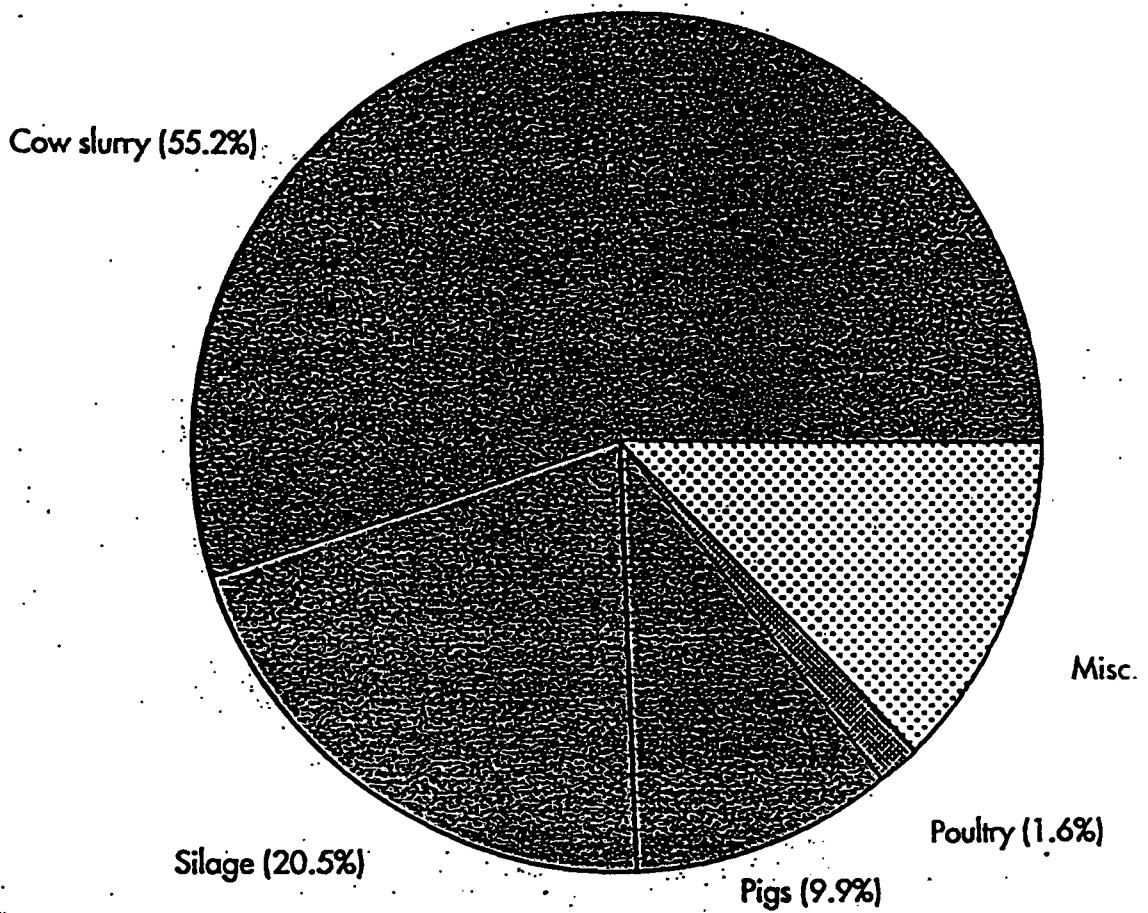
Although historically clearance of woodlands and land has continued over many centuries, mechanisation of agricultural practices since the Second World War have accelerated the process of nitrogen leaching (Payne 1989).

### **1.2.3 Sources of farm pollution**

Pollution from agriculture can be attributed to several major types of source material. Of the varying types of farm waste discharges, silage liquors are the most polluting even when partially diluted by rain water (see Fig's 2 & 3 & Table 1). Silage effluent is generated as a result of liquors emanating from the silage making process. The juice is acidic and of high organic strength. Volumes generated vary considerably depending on whether grass is wilted in the field prior to making silage and how much rainfall fell during the season

**Figure 1**

**Percentage of all farm pollution incidents (1985-1989)**



**Source N.R.A. (1992)**

**Figure 2**

Typical production of liquor  
from a silage clamp (from MAFF 1984b).

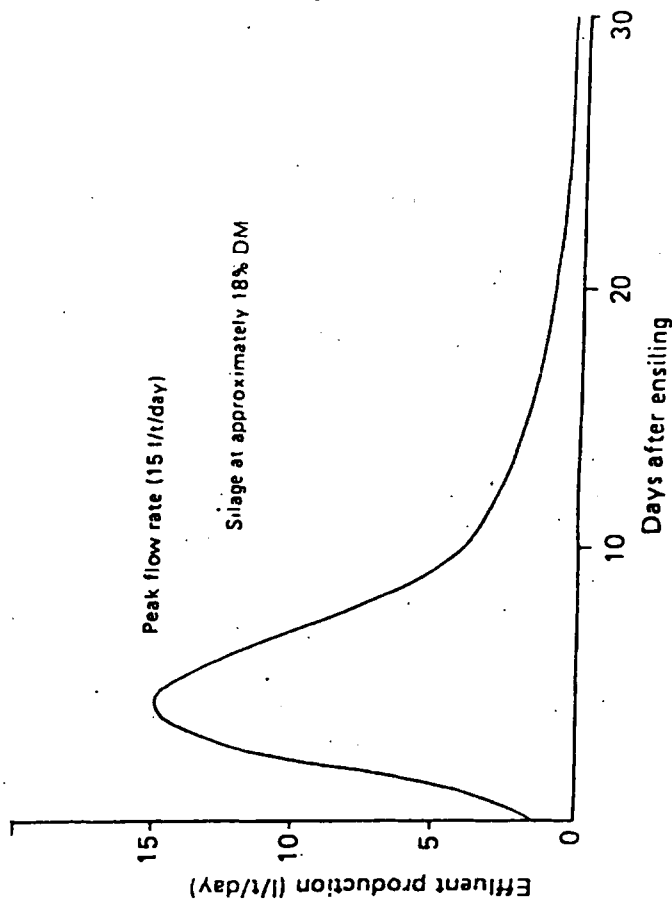
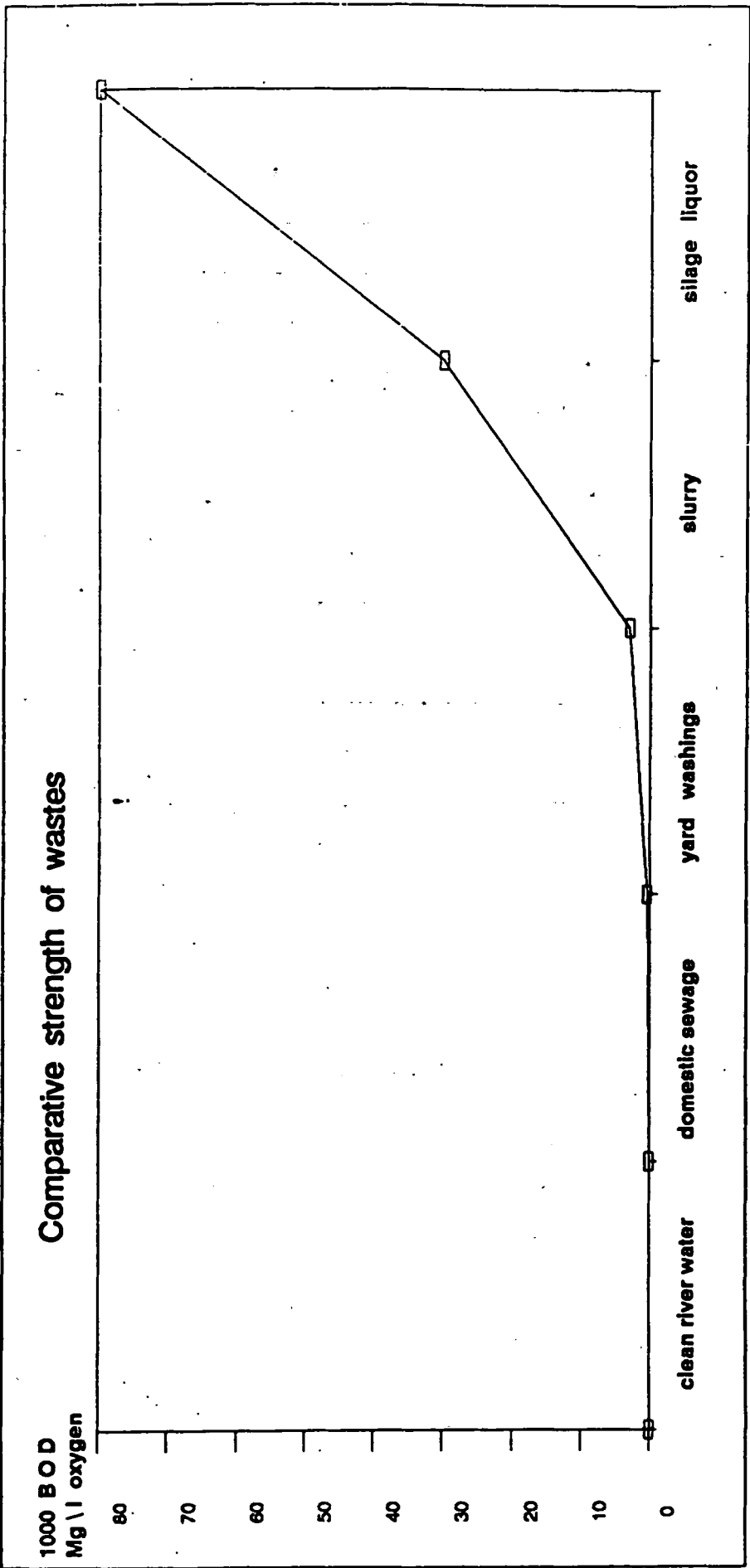


Figure 3



Source N.R.A.

(1992)

Table 1

Biochemical oxygen demand strengths of farm wastes - UK

	BOD (mg/l)
Treated domestic sewage	20-60
Raw domestic sewage	300-400
Vegetable washings	500-3,000
Dilute dairy parlour and yard washings (dirty water)	1,000-2,000
Liquid waste draining from slurry stores	1,000-12,000
Liquid sewage sludge	10,000-20,000
Cattle slurry	10,000-20,000
Pig slurry	20,000-30,000
Silage effluent	30,000-80,000
Brewer's grain effluent	30,000-50,000
Milk	140,000

Source NRA 1992

Table 2

Copper, Zinc and cadmium levels in slurry (from Van Erp and Smilde 1989)

All - g/100 kg manure

	Cd	Zn	Cu
Cattle slurry	0.03	5	3
Pig slurry	0.07	38	22
Chicken slurry	0.11	64	18
Chicken manure	0.35	205	57
Broiler manure	0.41	218	68

(Robertson 1977). The liquor is either directly toxic to aquatic life because of constituents such as ammonia or, due to its oxygen demand suffocating aquatic life and adversely affecting legitimate uses of water. Undiluted farm slurry has a Biochemical Oxygen Demand (BOD) varying between 3,000 and 10,000 mg/l whereas silage liquor has a BOD of 40,000 mg/l in comparison with domestic sewage strength of 400 mg/l (Robertson 1977).

Although silage effluent has historically been the most deleterious of farm discharges particularly in the west of the UK, (approx 40%) incidents in this category have been falling (NRA 1992). This may be explained by the dry conditions corresponding with hot summers and the consequent low moisture levels in harvested grass. Improved effluent facilities and safer disposal to land have helped, as has the increased popularity of bagged or wrapped "big bale" silage, which largely eliminates external effluent generation (McArthur 1993).

Slurries and effluents of various types are however a much greater volume in respect of material generated and subsequent polluting discharges (Fane 1989) (Table 1).

It is estimated that about 200 million tonnes/year of livestock waste is produced in the UK requiring disposal onto land, most of this originating from the livestock kept in intensive units (WRC 1979). The resulting manure and urine production creates a considerable potential pollution load. Other



farming activities, including the use of pesticides, can cause chronic pollution although numbers of incidents are comparatively small compared with animal waste incidents (Fig 1). More subtle pollution sources that are also important, are fertilizers such as ammonium nitrate and urea. Again numbers of acute incidents are relatively small compared with organic animal waste, but the input of nitrogen on a continual basis to rivers and aquifers is a significant long term problem (Payne 1989). Chemical strength of cattle slurries varies considerably depending on feeding materials and storage/aeration techniques (Suss 1989). In terms of its polluting load expressed as BOD, farm livestock generates 2.5 million tonnes of BOD every year in comparison with the UK population generating 1.5 million tonnes (Howells & Merriman 1987). The BOD load generated by the human population, is however, invariably biologically treated before discharge into a watercourse, whereas (at the present time) an effective treatment system for livestock waste is rarely used. All BOD associated with livestock waste applied to land has to degenerate by natural mechanisms within the soil structure. However research by Vetter and Steffins (1989) shows that applications of slurry were rarely optimal, instances of incorrect applications were noted to be widespread. If only 2% of material applied to land subsequently found its way into a watercourse then that would be directly equivalent to the load arising from the UK human population after conventional treatment. This illustrates the problem that the regulatory authorities have in controlling organic farm pollution. Drainage of effluent from land is unpredictable and is governed by factors such as soil type, climatic conditions and application rates. Pollution from this source into

rivers can occur at any time or place without warning and is therefore very difficult to regulate. In contrast, conventional sewage treatment uses well proven technology, (McArthur 1993) to remove BOD to a standard set by the National Rivers Authority (NRA).

The problems associated with piggeries are essentially similar to those of slurry production for cattle, but can be more serious, due to greater livestock concentration, and the higher organic strength of the slurry produced (Robertson 1977).

Sheep do not normally give rise to an effluent disposal problem although disposal of sheep dip may cause pollution (MAFF/WAA 1988). However pollution from agrochemicals is largely outside the terms of reference of this thesis.

Poultry wastes are high in organic strength with exceptionally high levels of ammonia, and copper and zinc on occasions (MAFF 1985b) (see Table 2). Although the poultry industry is geographically concentrated in areas such as East Anglia, historically it has not been a significant source of pollution (NRA 1992). Poultry units are frequently large and well managed units, with litter being removed as dry material for off site use. Hygienic cleansing of the housing produces small quantities of disinfectant contaminated effluent, that must be tankered away from site by licensed contractor.

However, trends in UK farming practices will affect these distributions and effects, since for example there has been a general decline in cattle stocks, but a tendency to increase herd size at remaining farms (Marsden 1990). Pig farming has also continued to increase in a number of areas, particularly East Anglia and Yorkshire (See Fig 5)..

A number of related activities to the primary farming enterprises can cause significant pollution problems (Table 3). Such industries are often situated on the farm complex for geographical and economic reasons. Effluent is generated from dairies and creameries, tanneries, fruit, vegetable and potato processors and packers. In addition fish farming is considered by many to be an agricultural activity that is discharging semi-contaminated wastes into freshwater rivers. The extent of the problem associated with fish farms is unclear, although Saunders-Davies (1989) states that nutrient inputs at some sites are considerable.

#### **1.2.4 Intensive Farming Practises**

The discharge of effluent from the farm complex is a common problem because most animals are housed within this area. Sources can be varied, from dairy effluent, silage liquor, slurry pit overflows and contaminated yard runoff to agrochemicals spillages.

**Table 3**

**Trends in UK sources of pollution - Numbers of pollution incidents/year**

Sources of Pollution	1985	1986	1987	1988	1989
<b>COWS</b>					
- Slurry stores	717	695	705	801	589
- Solids stores	185	143	148	194	121
- Yard/Palour washings	610	816	821	836	578
- Land run-off +	180	244	212	345	380
- Treatment system failure	116	177	84	96	65
- Silage Liquor	1006	592	1003	815	245
<b>PIGS</b>					
- Slurry stores	164	169	217	231	169
- Yard washings	85	89	54	59	64
- Land run-off	57	69	74	89	92
- Treatment system failure	7	21	21	20	19
<b>Others</b>	<b>383</b>	<b>412</b>	<b>551</b>	<b>655</b>	<b>567</b>
<b>Total</b>	<b>3510</b>	<b>3427</b>	<b>3890</b>	<b>4141</b>	<b>2889</b>

**Source - NRA (1992)**

Many farms in the UK are still based on their traditional building construction and as a consequence effluent generation is exacerbated by the mixing of clean surface and roof water with effluents.

Much research has been undertaken in recent years into the effects of dairy complex discharges particularly in the South West and Wales. A catchment study, (Schofield and Bascombe 1990), of the Eastern Cleddau catchment is one of the first to look at the problem from source on the farm, to the lower reaches of the river. They found that high loadings of ammoniacal nitrogen and BOD originated from drainage pipes leading from the farmyard areas, and in associated streams, peaks of pollutant levels were strongly related to periods of high rainfall intensity. Relatively little immediate effect was observed from runoff from slurry applied to land although the processes by which slurry may enter watercourses is still being investigated by field experiments (MAFF 1991B & Mainstone et al 1991).

The extent of the problem that has to be dealt with can be illustrated by the example of a 60 cow dairy herd that is housed in the farm complex on a slurry system. Such a relatively small herd will give a daily slurry output of approximately 1,000 gallons (220 m<sup>3</sup>). This figure is inclusive of cow dung and urine, parlour and yard washing water (Robertson 1977). In addition at many sites, clean surface water is inadvertently mixed with polluted slurry and effluents. This usually occurs for the following reasons:- No provision is made for the off site disposal of rainwater, consequently mixing with effluents

occurs with every rainfall. Drainage from guttering and downpipes on farm buildings outfalls on to yards, which then results in rainwater being inadvertently directed onto the contaminated slurry yard. Other farms have operational roof drainage separation schemes but clean and dirty yard waters are not separated. Separation of yard waters is uncommon because most farms will not consider redraining the farmyard complex for economic reasons. The requirements now stipulated under the new Control of Pollution (Silage, Slurry and Agricultural Fuel Oil) Regulations 1991 are comprehensive.

The piggery drainage system is frequently more simple in design, and water use is not so high as that needed on the dairy complex for hygiene purposes. However most piggeries are large complexes with in excess of a thousand pigs on many farms. The amount of slurry that is produced by a single fattening pig can be on average 10 l/day. Thus a unit of 2,000 fattening pigs will produce the same amount of effluent as the 60 cow dairy herd. Although the farm complex would be similar in size, the land required to graze 60 milkers would be in the order of 100-120 acres, whereas the piggery would only require additional land for effluent storage.

Piggeries are not necessarily slurry or effluent producers since straw bedding systems will not produce effluent if the subsequent manure is taken to the application field, rather than stored on the farm (Robertson 1977). There is also a recent tendency for pigs to be grazed on open fields if the land is light,

thus considerably reducing effluent production. By contrast the dairy herd will always generate a proportion of slurry and effluent even if limited winter grazing is carried out, since milking collecting yards and parlours will produce effluent. Beef fattening yards and calving pens are traditionally straw bedded and historically effluent runoff has not been a problem.

#### **1.2.5 Land Application of Manures, Slurry and Effluent**

To dispose of the above waste products from livestock enterprises on to agricultural land is, in most instances, the only economic and environmentally sound disposal technique (Long 1992). As these polluting materials are not treated prior to application on to the land a pollution risk by direct contamination of surface or groundwater, is always present. This can occur by surface runoff or by rapid movement through the soil into fissured rock or land drain systems. Site suitability is a crucial factor, since to minimise the risk, soil type, soil water content, and gradient must be accurately assessed to make application a safe disposal technique (Schofield & Bascombe 1990).

Two contradictory factors are apparent when disposing of those materials to fields. Most land is efficiently drained yet farmers are advised to utilise land effluent disposal systems. Light soils have a self draining ability, and most lowland medium to heavy soil types (particularly the clays) have been under-drained (Morris 1989). The danger from particularly excessive application of effluent, is that the liquid will find its way into land drainage systems, and then directly outfall into a watercourse. A particular problem can exist where

old uncharted drains may still be partially functioning and inadvertently cause effluent to be discharged.

Pollution of groundwaters by farm effluent has not been extensively researched as chronic effects into surface waters are a more immediate problem (see Fig 4). Short term effects, particularly on shallow soils over limestone or chalk are, however, the greatest pollution risk (Skinner 1987) for aquifers utilised for water supply purposes. The danger is that normal self purification mechanisms will be ineffective if the effluent finds its way quickly through the top soil and then enters and contaminates the groundwater aquifer.

It is now generally agreed by bodies which include MAFF, NRA, WRC and NFU, that disposal sites can be categorised in terms of risk to rivers and aquifers and that those which are very high risk should not have effluent applied under most circumstances. These have been included in the Code of Good Agricultural Practice for the Protection of Water (MAFF 1991B). Under the "do not apply" category the following are given:-

**Frozen, waterlogged and adjacent to a watercourse.**

**At field capacity, on heavy soil, on steep slopes near to watercourses.**

**Field surface cracked to the depth of field or mole drains.**

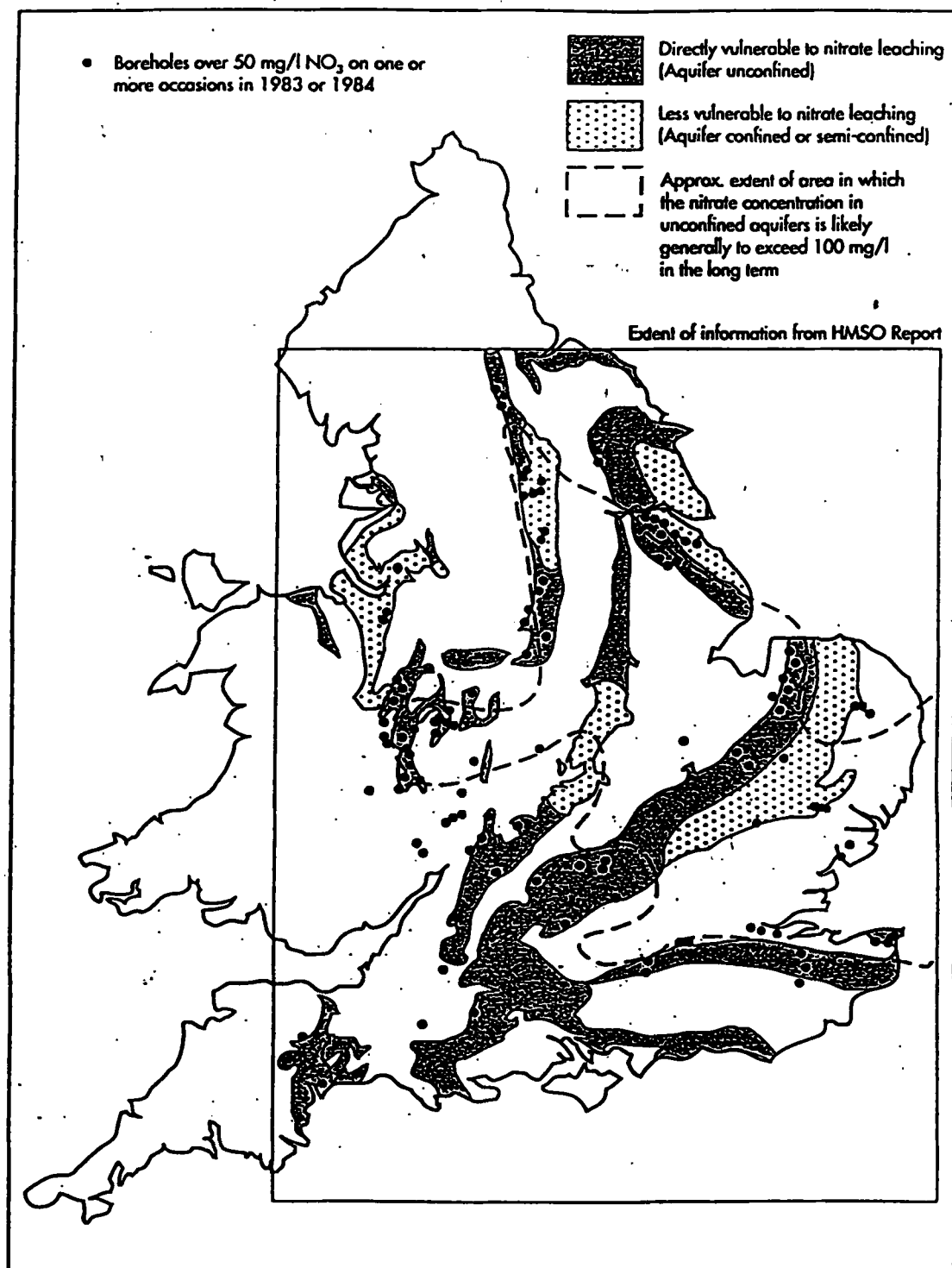
**Drainage systems installed within the previous twelve months.**

**Soil depth over fissured rock is less than 30cm and cracked.**



Figure 4

Aquifers and the vulnerability of groundwater to nitrate pollution



Most of these categories would not be utilised by the majority of common sense farmers, however detailing them in the code of practice will give a legal framework to offences committed when careless applications in the very high risk category have occurred (MAFF 1991b). A separate category of high risk sites which should not have high rate applications, are those that are adjacent to a stream, on sloping heavy ground and where field capacity has been reached and where soil depth over fissured rock is less than 30 cm. These categories apply equally to manures, slurries or effluents. Where applications are made to high risk areas the rates should not exceed a fixed precipitation rate of 5 mm/hour or an application rate 50 m<sup>3</sup>/hectare for moving applicators. Although these rates are recommended for high risk areas the recommendations equally apply to most soil types excepting light lands (Mainstone et al 1991). Although manufacturers of low rate irrigators now market products able to irrigate at the optimum rate of 5 mm/hour, higher rates have historically been applied since the equipment was not available for low rate spreading. Standard irrigation equipment and slurry tankers are still commonly used, and provided great care is taken in the application technique, minimal problems should ensue. It should be noted however that when considering applications, the total amount of nutrient and material than can be applied in any one year is limited to ensure that nitrogen and phosphorus available from the waste is fully utilised by the growing crop (Payne 1989) (See Tables 4 & 5).

**Table 4**

**Mean chemical content of cattle slurry (Suss 1989)**

mg/g unless stated	Dairy	Mean value mixed farms	Bull-farms
Dry matter (%)	7.5	7.7	8.8
Org. matter (%)	74.9	74.9	78.2
NH <sub>4</sub> -N	2.4	2.9	2.6
Total N	4.3	5.1	4.6
P <sub>2</sub> O <sub>5</sub>	2.0	2.1	2.1
K <sub>2</sub> O	6.3	6.4	5.3
CaO	2.4	2.1	2.0
MgO	1.1	1.1	1.3

For the majority of livestock enterprises the land area available for disposal should be such that the application rate does not exceed 250 kg/ha/yr of total nitrogen in applied manures, slurries and effluents (See tables 5 & 6). At present, analysis of nutrient contents of various wastes is rarely undertaken by individual farmers and there is a tendency to rely on data produced by agricultural research organisations. There is a growing need for this information service to be made available to individuals as it will be needed to comply with application rate legislation proposals. Care is required to calculate application rate and timings, as well as ensuring even applications, to minimise nitrate leaching risk (Howells & Merriman 1988). Autumn or early winter applications of slurry to uncropped land are likely to lead to a significant increase in nitrate leaching and should be avoided in problem areas

Table 5

Recommended land areas for disposal of effluent UK

1 Dairy cow (6 month housed)	0.16 ha.
1 Beef bullock (6 month housed)	0.10 ha.
1 Pig place (20 - 90 kg)	0.04 ha.
1 Sow and litters (to 4 weeks)	0.07 ha.
1000 laying hen places	2.3 ha.
1000 broiler places	1.4 ha.

Typical figures to meet the recommended maximum loading of 250 kg/ha/yr of total nitrogen in applied organic manures

Source - NRA (1992)

Table 6

Maximum livestock numbers per hectare of land available for slurry spreading, as proposed by EC Directive COM(88)708.

Livestock type	Maximum no of livestock ha.
Dairy cows	2
Young stock or beef cattle	4
Fattening pigs	16
Sows with piglets	5
Turkeys, ducks	100
Laying hens	133
Young hens, 0-16 weeks	285

(See Table 7). Land area required is dependent on animal type and many authors have found that inadequate disposal area is a common weak point on smaller farms (Robertson 1977). To meet the nitrogen requirements detailed previously one dairy cow will need 0.16 ha whereas a fattening pig requires 0.03 ha.

**Table 7**

**Percentage nitrogen lost to leaching from slurry applied to crops and grassland (Archer J R 1989 - not published)**

	Nitrogen leached expressed as % of total manure N applied	
	Arable	Grass
Farmyard manure - autumn	15	10
- winter	10	5
- spring	10	5
Cow/pig slurry - autumn	30	10
- winter	15	10
- spring	5	5

Soil injection of slurry offers an alternative which has a number of advantages over surface spreading. Hall (1986) and WRC found that it was a means for meeting environmental quality objections, as injection often reduced public complaint, gave better pasture hygiene, nutrient management and soil loosening. However, it is still dependent on care in respect of field slope and soil moisture state, if pollution problems are to be avoided. Kemppainen (1986) found that injection was particularly effective just before sowing and that autumn and winter treatment was as ineffective as surface applications

were at that time.

There has been a trend apparent in East Anglia for small farms/holdings to start intensive pig rearing units on an average of 10 - 20 acres, without room for low rate irrigation (NRA 1992). Fig 5 shows the high intensity of pig farms in Suffolk, many of which are smaller units. By implication a small farm will not generate a large income for purchase of essential disposal equipment and associated construction works, such as lagoons and low rate irrigators. Some small farmers partially resolve this problem by relying on land and equipment available from large holdings adjoining theirs.

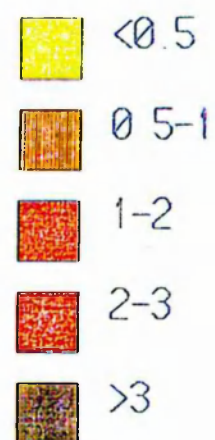
#### 1.3.1 Water Chemistry

Ammonia is one of the most important parameters to be considered when examining the inter-relationship between river pollution and farm pollution, (Wheeler 1979), since it is present in high concentrations in all animal wastes and is increased by some treatment processes such as lagooning. Ammonia is toxic to fish at levels as low as 1mg/l, dependent on pH and temperature (Alabaster & Lloyd 1982). Although it has the capacity to nitrify within the soil and a river system, it is normally passed through the self-purification systems so quickly that minimal nitrification takes place. Schofield & Bascombe (1990) notes from studies in the Cleddau catchment that ammoniacal nitrogen and dissolved oxygen show an inverse relationship where rainfall was generating runoff from farmyards intermittently. It should be also noted that excessive amounts of ammonia can cause problems with disinfection

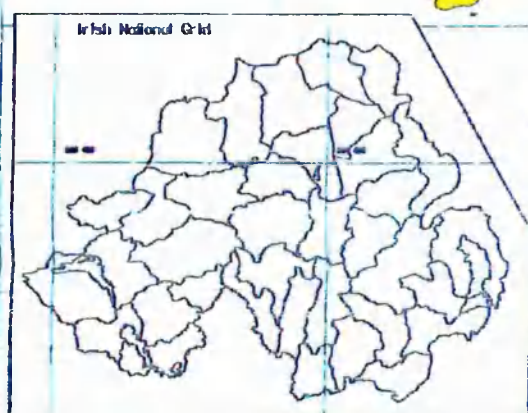


**Pigs : density**  
**By River Catchment**

Head/Ha agric. land



**Figure 5**



N

000 000



at water company intakes (Wheeler 1979) since the combination with chlorination causes taste problems for the consumers.

Depletion of oxygen levels is a direct effect of the organic load (measured by the Biochemical Oxygen Demand) associated with organic farm effluent discharges.

It is generally believed that many of the British rivers that are not classified as "very clean" in the DOE survey, (NRA 1992) are affected by farm incidents (Cole 1990). It is however not always possible to separate the effects of farm sources from other effluents with similar effects. The most common cause of long term deteriorations in river quality is a combination of agricultural and other effluent. In rural locations, the monitoring of very minor streams would conclusively establish if agricultural sources are the most significant polluting load. However it is rare for the NRA to be able to provide the resources to have a monitoring network of small streams. Key points in the upper reaches of the main river systems are monitored but these will not usually reveal the discrete source of polluting loads. The studies in the Eastern Cleddau (Schofield & Bascombe 1990) were based on a small catchment in a very rural area and have been able to illustrate for the first time effects from individual farms and the consequent combined polluting load in the river systems.

Recent research and discussion have been developing the principle of



catchment management where it has been established that agricultural pollution is a significant problem. The Wessex Region Catchment control areas have developed in this manner as an in-depth catchment study including the review of consents. As a result of NRA visits, this action has begun to improve river water quality in some areas, following the construction of a substantial number of farm effluent schemes (NRA/MAFF 1992). It is likely that this type of approach will be adopted on a national scale, with the requirement for Farm Waste Management Plans at those farms where there is a potential risk of pollution or where effluent storage is below the minimum 200 days statutory requirement.

#### **1.3.2 Biological Implications**

The NRA biological monitoring programme of small streams near agricultural sources is even less comprehensive than water chemistry sampling. It does however provide an excellent method of assessment when a polluting source has been located. Biological surveys using for example the Biological Monitoring Working Party scoring system (NRA 1992) will provide a quantitative assessment of long term deleterious effects of intermittent or discrete discharges that water chemistry may not reveal. Although biological monitoring can reveal a depleted biological community, it will not always differentiate between a farm organic discharge and a pesticide spillage affecting the stream. However, where gross organic pollution has occurred it is common to observe various types of fungus smothering the stream bed.

These biological assessment techniques (Schofield & Bascombe 1990) subsequently developed by Welsh Region are in areas where diversity of biology community is high and may therefore be a less useful technique in lowland areas where diversity is already low because of inherent physical features.

Developments have recently taken place with respect to in-situ toxicity tests, since concerns had been expressed that farm pollution may have had a direct effect on benthic macroinvertebrate communities. In-situ caged invertebrate tests have been undertaken with mayflies Ecdyonurus dispar and freshwater shrimp Gammarus pulex (Maltby & Naylor 1989). The results indicate that a chemical mixture of high ammoniacal nitrogen, high BOD, and low dissolved oxygen are not always directly toxic to them. However continued exposure to sublethal levels of chemical pollutants can affect growth of an organism (Maltby and Naylor 1989) and hence indirectly influence longevity and fecundity. Blanketing of the stream bed with material will however directly affect invertebrate distribution through habitat loss and oxygen depletion (Reynoldson 1987). In reality this test is expensive and has little practical application.

### 1.3.3 Fishery Impacts

One of the most significant effects on Britains freshwater rivers from farm effluents is that pertaining to fisheries. The small tributaries and upland streams that can be polluted from agricultural sources are breeding grounds

for a variety of fish.

Fishery surveys of the UK rivers are generally produced annually by the NRA and have revealed low fish stocks in areas such as the River Waveney Valley, Suffolk, which in the past were indirectly attributed to uncontrolled farm inputs (Anglian Water 1986).

In order to understand the effect on fishery populations following farm effluent spillages, electrofishing may be undertaken to determine the extent of fish mortality and its subsequent rates of recovery. Studies in Wales (Schofield & Bascombe 1990) have shown that recolonisation of affected stretches of river by adult fish, (salmonid) is very limited even over a period of twelve months or more, with only newly spawned underyearling fish being the main colonists. The conclusions that can be drawn have to be carefully considered, since flow and weather conditions also have a significant influence on recolonisation.

Records of fishery stocks in rivers subjected to continual moderate strength farm inputs reveal a degree of tolerance (Anglian Water 1986). Chronic effects only become apparent when a catastrophic event occurs.

The use of fishery records to assess long term effects of farm pollution in a particular catchment, is at the present time an innovative method.

#### **1.4 Legislation Chronology**

**The records of farm pollution incidents produced by MAFF and NRA do not show any significant decline in the last decade (NRA 1992). Self regulation and persuasion are not therefore appropriate for the farming industry, and government has concluded that restrictive legislation must be in place for enforcement agencies to be effective. Detailed below are legislation "events" which clearly show that the most recent legislation is more specific and detailed.**

**It is suggested that legislative controls may be a significant factor influencing farmers attitudes and actions in respect of farm effluent control. However, the period of preparation of legislation may also be a period when farmers will react positively in order to be subsequently compliant when legislation has been put in place.**

**Legislation detailed below has in the last three decades become very comprehensive and wide ranging to control the activities resulting from modern farming practices (NRA 1992). For the first time legislation applies to activities and construction works within the farm complex, rather than traditional control of pollution discharges. Both types of legislation are now in force and complement each other in management of farm waste problems (NRA 1992).**

The negative side of such extensive legislation is that a considerable financial penalty exists for those farmers who are to be fully compliant with all legislation (Cousins 1993). Construction of a farm effluent scheme in accordance with all the statutory requirements will frequently cost £20,000 to £30,000. By contrast typical fines for first offences in respect of a farm effluent discharge are between £3,000 to £8,000. There is, therefore, considerable incentive for "making do" and not attracting attention by allowing pollution to occur. Although many farmers may escape the attention of NRA and MAFF, the introduction of intensive catchment surveys mean that all such farms will eventually have to be brought up to standard in a fair and equal manner (Dampney 1978). If works are not agreed on a voluntary basis between NRA and the farmer, formal notice can be given detailing works required and timescales to be met.

Another aspect frequently overlooked is the technical complexity of legislation and the inability of the average farmer to be familiar with it all (Falkingham 1993). Legislation is however formulated for the greater environmental good of the whole community and is rarely of any direct benefit to the farmer.

**Important legislative events are as follows:-**

- a) Rivers (Prevention of Pollution Act) (1951) - Any new discharge of farm effluent requires river authority consent.
- b) Rivers (Prevention of Pollution Act) (1965) - All existing farm effluent

discharges must have an application made to the river authority.

- c) **Control of Pollution Act (1974)** - Repeats much of the above legislation. Important new provisions in respect of the Code of Good Agricultural Practise which could be used as a defence. The code details requirements in respect of effluent disposal volumes, vicinity of nearby streams, and disposal mechanisms.
- d) **Water Act (1989)** - Replaces many of the section of COPA and includes a new Code of Good Agricultural Practise under Section 116 of that Act.
- e) **Section 110 of the Water Act 1989** has led to the adoption of the Silage, Slurry, and Agricultural Fuel Oil Regulations that are now mandatory.
- f) **Water Resources Act (1991)** - Updates to a minor extent the Water Act (1989). The relationship between the implementation of this legislation, grant aid and other factors is shown in Fig 6.

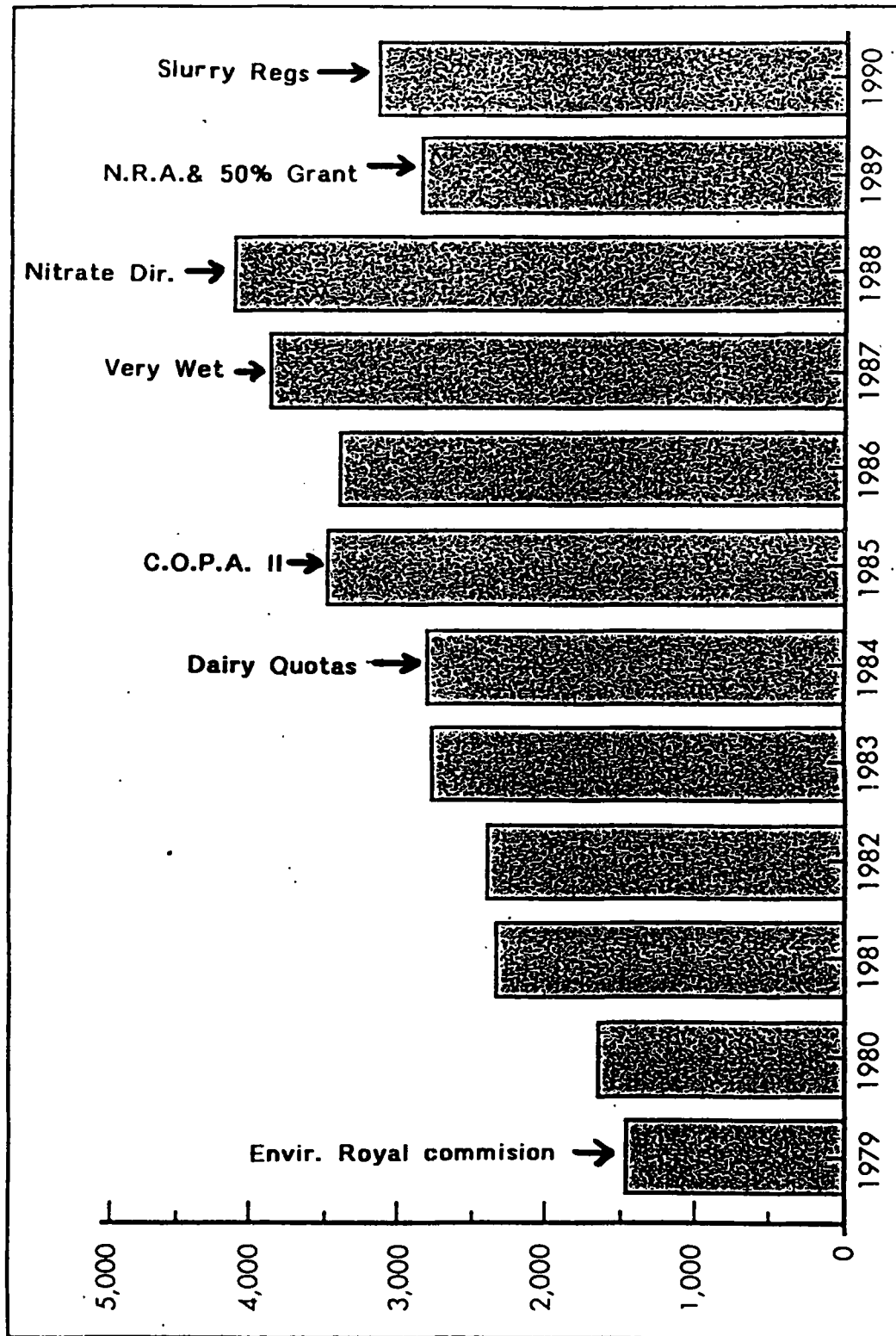
## **1.5 Research and Development**

We have established from the literature that farm effluent pollution continues to be a significant problem in the UK. Equally much legislation has been put in place that is not going to be effective without the co-operation of the farming community (NRA 1992).

In this research project the aim was to establish what factors encourage farmers to co-operate with governmental bodies. Little is known about their principal information sources and what formulates their attitudes and beliefs.

Figure 6

Farm pollution incidents (1979-1990)



The principle aim was to establish if livestock farmers felt disadvantaged with respect to cereal farmers as a result of numerous environmental controls. Secondly did livestock farmers consider such constraints were inappropriate to their industry and would lead to potential economic decline.

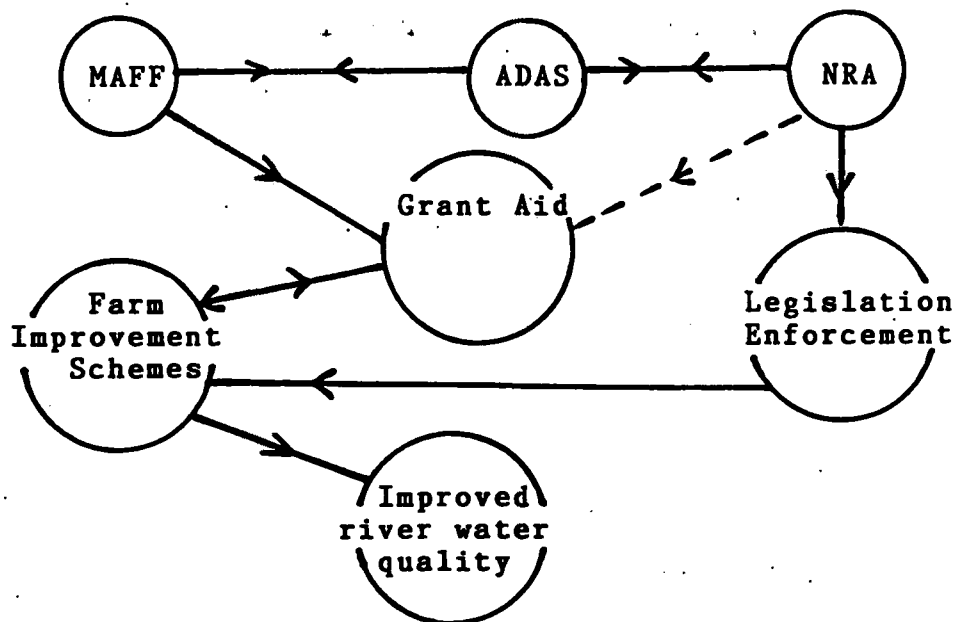
The research involved testing various hypotheses (see Figs 7, 8 and 9) and concepts to establish patterns in the attitudes of farmers. A variety of research methods were used, firstly a literature search to establish the extent of existing work in this area of research. Subsequently, a series of questionnaires were sent to farmers in East Anglia to determine their attitudes and actions with respect to a variety of topics including legislation, finance, sources of advice and pollution control work undertaken. Lastly, analysis of farming press articles and interviews with editors and journalists to determine information sources and selection processes were undertaken.

Other associated areas of research have included an analysis of farm pollution statistics in an attempt to match these with events such as periods of heavy rainfall, new legislation, grant changes and changes in prosecution policy. A study of other factors in agricultural catchments, to determine if enforcement policy and improvement campaigns were effective was carried out, which included interviews and discussions with farmers, ADAS Officers, NRA staff and others, to determine how legislation has been interpreted, implemented and enforced.



**Figure 7**

Original Hypothesis - Water Quality and Agriculture



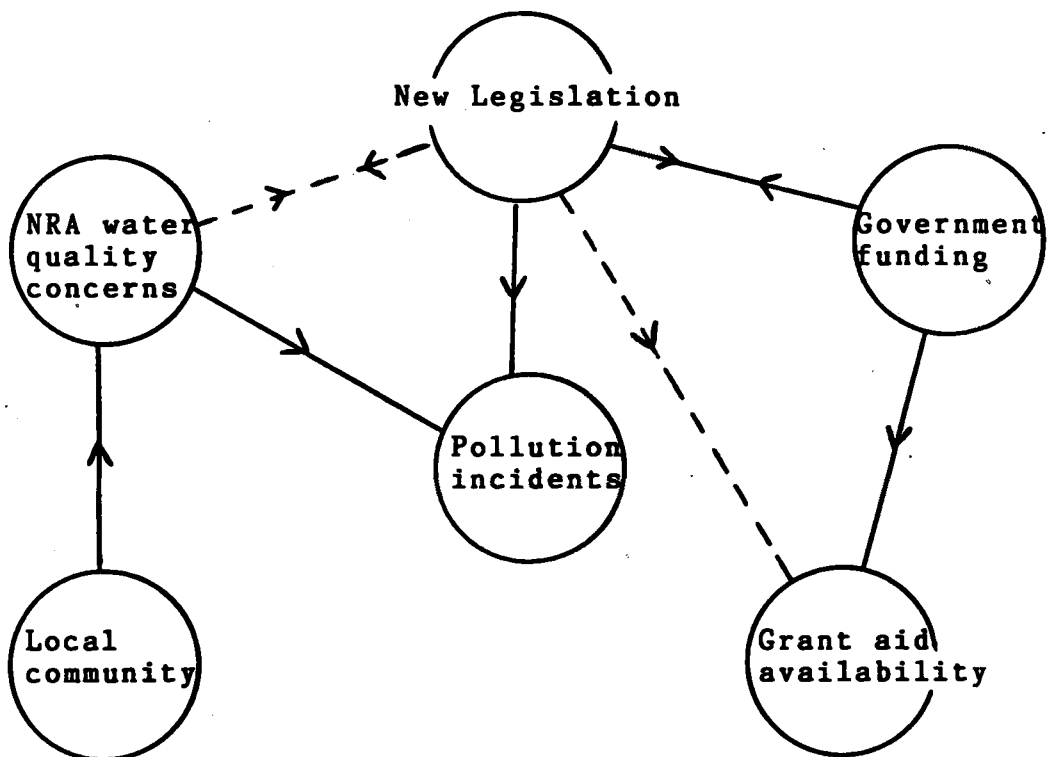
**Statement - Changes in river quality are directly linked to elimination of farm discharges.**

**Note - Arrows indicate influence paths and links between elements (solid lines). Broken lines show indirect influences.**

**Figure 8**

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Original Hypothesis - Pollution Statistics Links

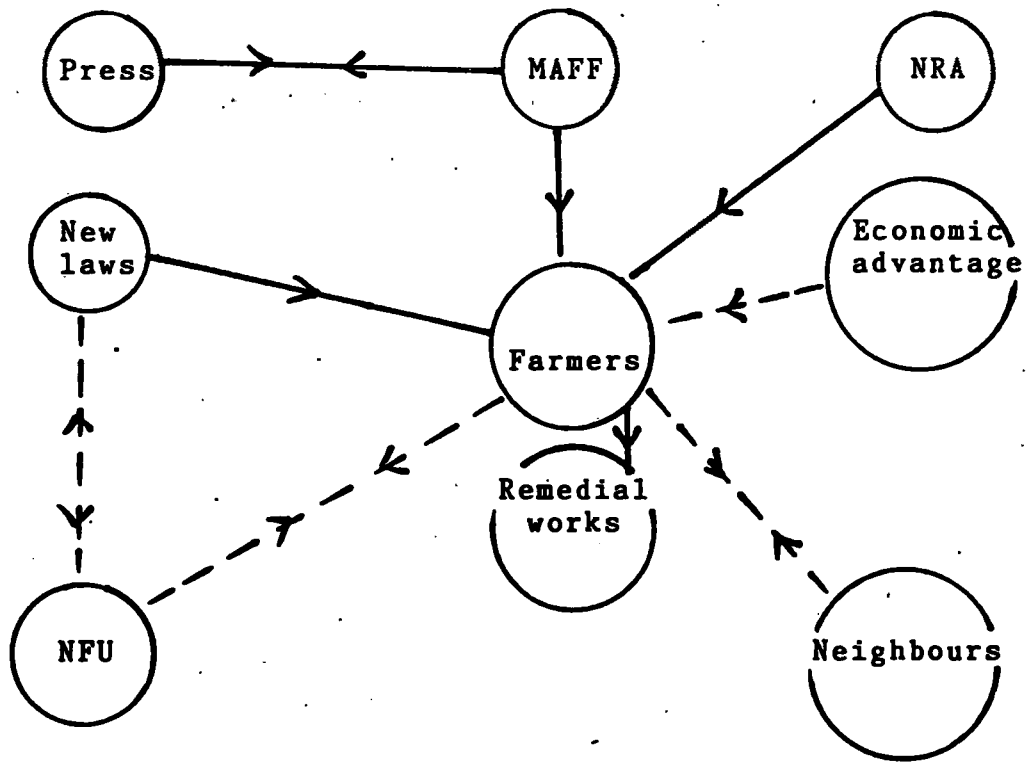


**Statement - Agricultural pollution incident statistics may be directly linked to specific changes in the law and grant aid etc.**

**Note - Arrows indicate influence paths and links between elements (solid lines). Broken lines show indirect influences.**

**Figure 9**

Original Hypothesis - Farmers attitudes and actions



**Statement - Farmers attitudes and actions regarding agricultural pollution are derived from governmental advice.**

**Note - Arrows indicate influence paths and links between elements (solid lines). Broken lines show indirect influences.**

There are a number of areas requiring clarification with respect to influences in the area of control of pollution arising from farms. One major factor that has not been well researched is farmers attitudes to control of pollution. The project examines their attitudes, the factors that affect attitude and subsequent actions, and suggests ways in which farmers can be actively encouraged to control pollution.

An associated area of work in 1991 by Carr and Tait (1991) in respect of farmers attitudes to conservation matters gave a number of clues to some of the farmers behavioural patterns. They stated for example that "Beliefs can be changed relatively easily, by providing new information or by changing the institutional or commercial framework within which people operate. However deeply held values may be very resistant to change. Legislation and regulation may be the only effective means of ensuring long-term change if this proves to be the case". These are areas that will be investigated in depth by the use of interviews and questionnaires. Some commonality between conservation and pollution issues does exist in respect of the farming community.

To be more effective at implementing a blend of advice and legislative enforcement, authorities must be able to provide effective advice that will then result in subsequent translation and implementation of it.

Carr and Tait (1991) make the point in conclusion that "Advice and training

can be directed at increasing the relevance of underlying attitudes which favour conservation. Detailed attitude studies provide a sound basis for supplying such advice".

By providing detail in respect of attitude patterns to authorities such as NRA and MAFF it is possible that they can work with farmers more effectively, and potentially reduce the current unacceptable high numbers of farm pollution incidents.

## **CHAPTER 2**

### **FARM POLLUTION STATISTICS AND IMPACTS**

#### **2.1 Introduction**

It is a general assumption in governmental circles that farmers will respond to changes in legislation, grant aid, and that these responses may then be reflected in the numbers of agricultural pollution incidents and potentially water quality statistics. In this section, the available data is examined to see if any such relationships can be demonstrated. Pollution statistics related to agricultural incidents are compiled by either MAFF and the NRA, or in combination (MAFF/WAA 1988). Normally an annual summary is released to the public and brief comments made on trends (MAFF/NRA 1989). The factors that might affect pollution from agriculture include:- New legislation proposals, enforcement policy with respect to new legislation, grant aid availability, grant aid capital allocation, significant "*movements*" in market prices for livestock, extremes of weather ie very dry or wet, formation of NRA, alterations in EC subsidies, net farm income trends, environmental policy of government and public opinion and major public prosecutions of farmers (see Fig 6).

The hypothesis I have used in this section initially states that:- beneficial changes in river water quality are directly linked to the elimination of farm effluent inputs into watercourses".

NRA has cited that a pollution prevention campaign in particular areas has been successful in reducing numbers of incidents (NRA 1992). Often such success is only short term and it is not clear that there is any causal link between the campaign and changes in the numbers of incidents.

Collection of national records started in 1979 by MAFF in association with the River Authorities, and has continued on an annual basis to the present time (See fig 6). The baseline annual number of incidents in 1979 was approximately 1500, and it appears to have peaked in 1988 at 3400, since when a reduction to 2300 incidents has occurred. It is possible that one factor in this reduction in the last three years, resulting from the pollution prevention policies of NRA and MAFF.

In reality many other factors interrelate to give a particular catchment water quality. For example sewage effluents also have an influence, and the authorities do not have knowledge of all effluent incidents in particular catchments. Certainly the hypothesis of a direct link between - MAFF/NRA → Farm schemes → Improved river water quality , is impractical to prove.

Farm pollution incident statistics can be utilised by a variety of organisations as a basis for legislative change, grant aid variation and governmental department reorganisation. They are potentially a powerful statistic and show a clear upward trend since the second world war, increasing as agricultural productivity improved. Much is made of the high proportion of farm

pollution incidents relative to other types of pollution from other sources (NRA 1992). However when taking account of the size of the UK agricultural livestock industry, the percentage of pollution incidents is not excessive compared with some other UK industries (Paynting 1987). It could equally be argued that in previous centuries, a significantly larger livestock population gave rise to a "diffuse" source pollution problem that was of equal magnitude to that of today. However concentration of farms in large intensive holdings now exacerbates this historic problem.

The bias and fluctuation from a wide variety of factors affecting the statistics is inherent in the system and in reality makes interpretation of short term trends unreliable. Such factors as the weather, changing crop patterns, grant aid changes and methods of compiling the statistics all affect the end result to a greater or lesser degree.

#### **2.2.1 Historical trends - Livestock**

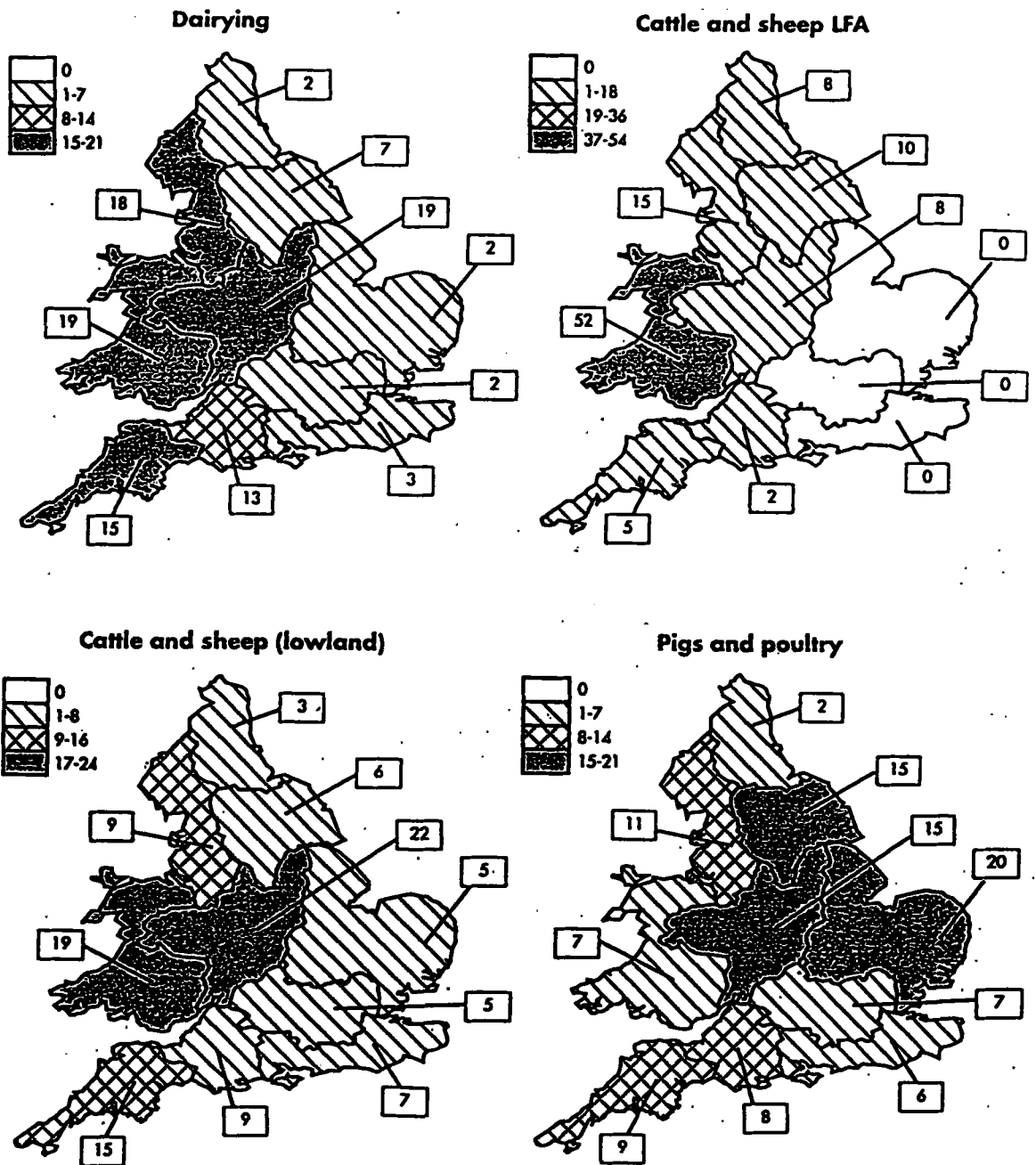
Although overall trends can be observed in the differing types of farm effluent pollution, geography has a major influence (see Fig 10). For example the West of England with its predominance of dairy farming has a high proportion of silage incidents whereas East Anglia with a high pig population has a large number of organic slurry pollutions (NRA 1992).

Soil structure and its suitability for effluent disposal mean that a very high



**Figure 10**

**Approximate percentage distribution of holdings**  
**by farm type (1986)**



**Source M.A.F.F. (1989)**

population of pigs and poultry in East Anglia combined with a heavy clay soil inevitably causes regular serious runoff problems (see Fig 10 & Fig 11). East Anglia has as a consequence by far the highest number of pig slurry and poultry incidents over the last fifteen years. By comparison the number of pollution incidents from silage liquor and cow slurry in the West of England is between 300 and 550% higher than those recorded for the East of the UK.

### **2.2.2 Historical Trends - Other Sources**

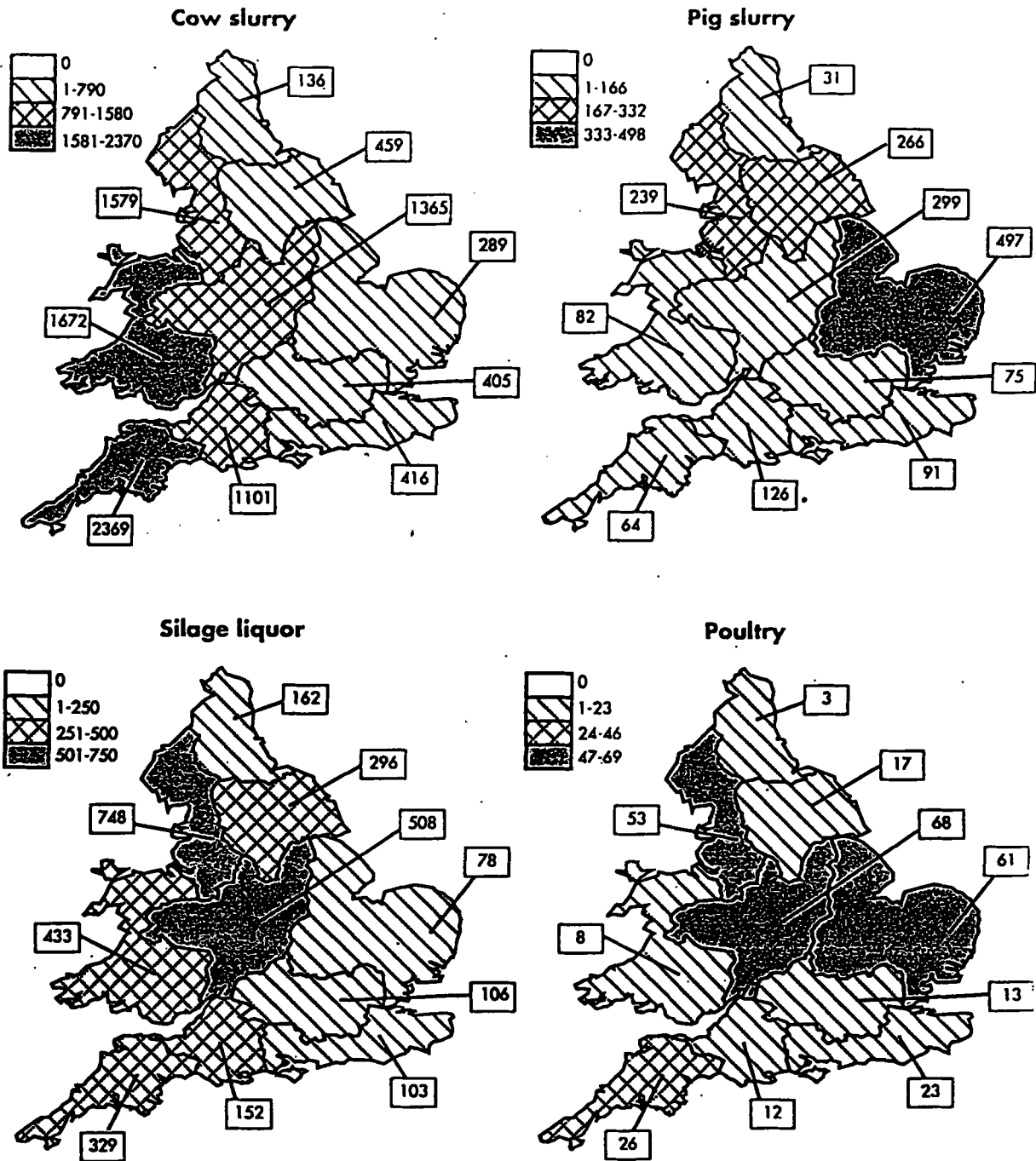
Apart from the chronic polluting effect of organic wastes, agriculture also contributes to diffuse pollution of rivers and groundwaters with substances such as nitrate and pesticides (Vetter & Steffens 1989).

Data show an exponential trend in nitrate in UK rivers since the second world war, with seasonal variability suggesting that agriculture is the major source of nitrate in combination with treated sewage effluent (see Fig 12). The data also show within the last four years that rises in nitrate runoff have now ceased and a small reduction in seasonal peaks is now evident (Payne 1989). Chronic pollution incidents from ammonium nitrate can also occur, however the evidence is that these pollution types peaked in 1986 (MAFF/NRA 1989).

The evidence of rising nitrate levels in groundwater is somewhat more problematic since it is attributed largely to the practice of ploughing up permanent pasture together with increased nitrate usage (Payne 1989).

**Figure 11**

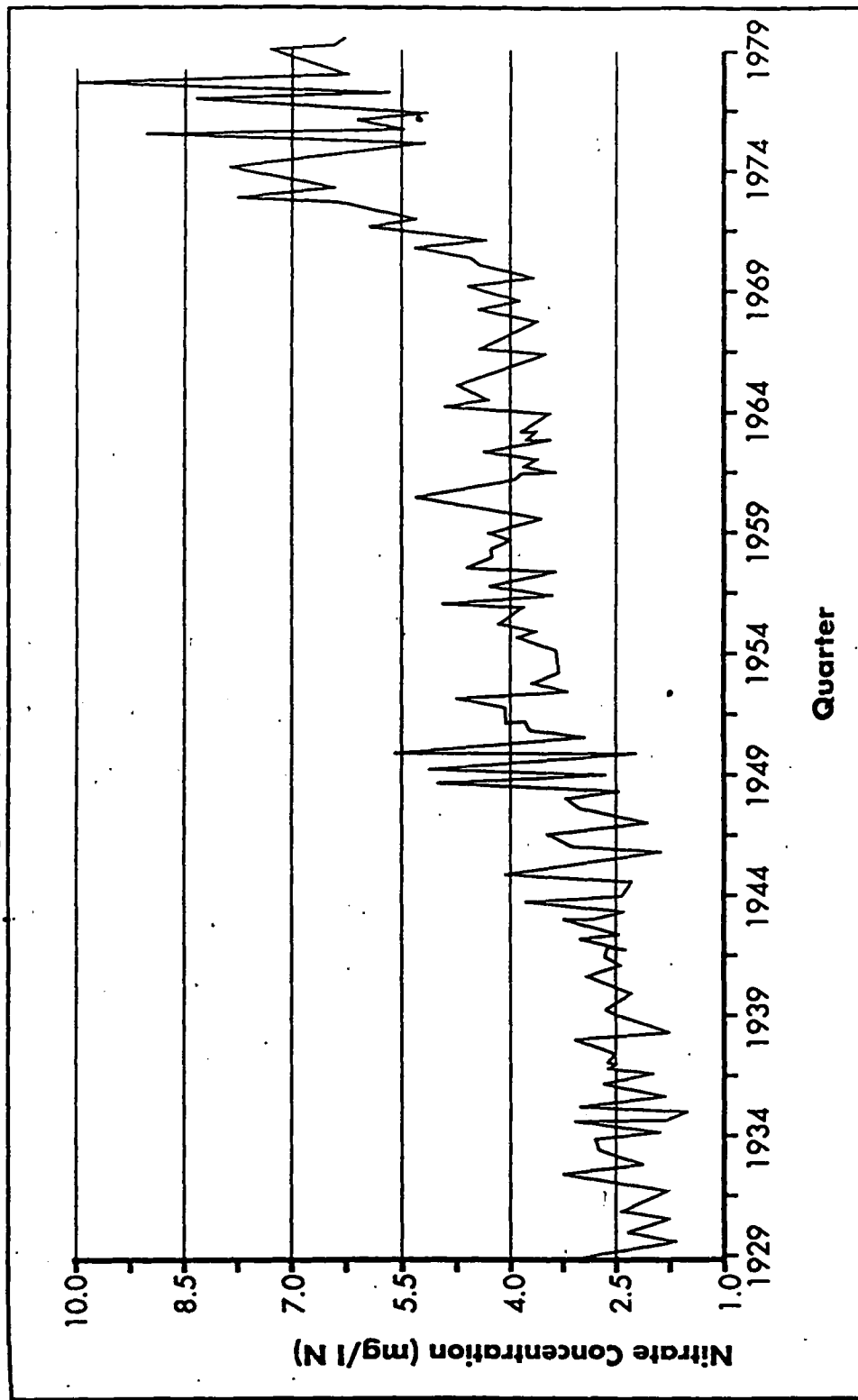
**Distribution of total pollution incidents  
from organic waste (1985-1989)**



**Source M.A.F.F. (1989)**

Figure 12

Mean quarterly nitrate concentrations, Walton  
intake on the River Thames (mg/l N) (1929-78)



Source N.R.A.-(1992)

Pesticide pollution shows a similar pattern to that of nitrate with chronic events, and a separate diffuse long term problem. Geographical variability is however more evident because of higher usage in cereal areas such as East Anglia (see Fig 13). Groundwater pesticide pollution is due to a combination of agricultural usage and that by public utilities, but statistics and trends cannot be drawn, since it is only recently that historic pollution has become evident and the problem quantified in selected aquifers for the first time (NRA 1992).

### **2.3 Compilation of Data**

Although the questions asked in the annual farm waste report have varied little over its compilation period, the interpretation of them by different staff has varied. For example the number of incidents reported varies with the staffing structure in particular regions and areas of interest and concern. Personal field notes show that varying members of the NRA have different attitudes to prosecutions and consequently personal bias must be taken into account when using prosecution statistics (see Table 8). For example, regional variation could be entirely due to senior management in that NRA region having a tough prosecution policy (See Fig 14), although statistics indicate a linear relationship between regions.

Other factors are evident from discussion with MAFF and NRA staff. What

Figure 13

**Distribution of total pollution incidents from pesticides (1985-89)**

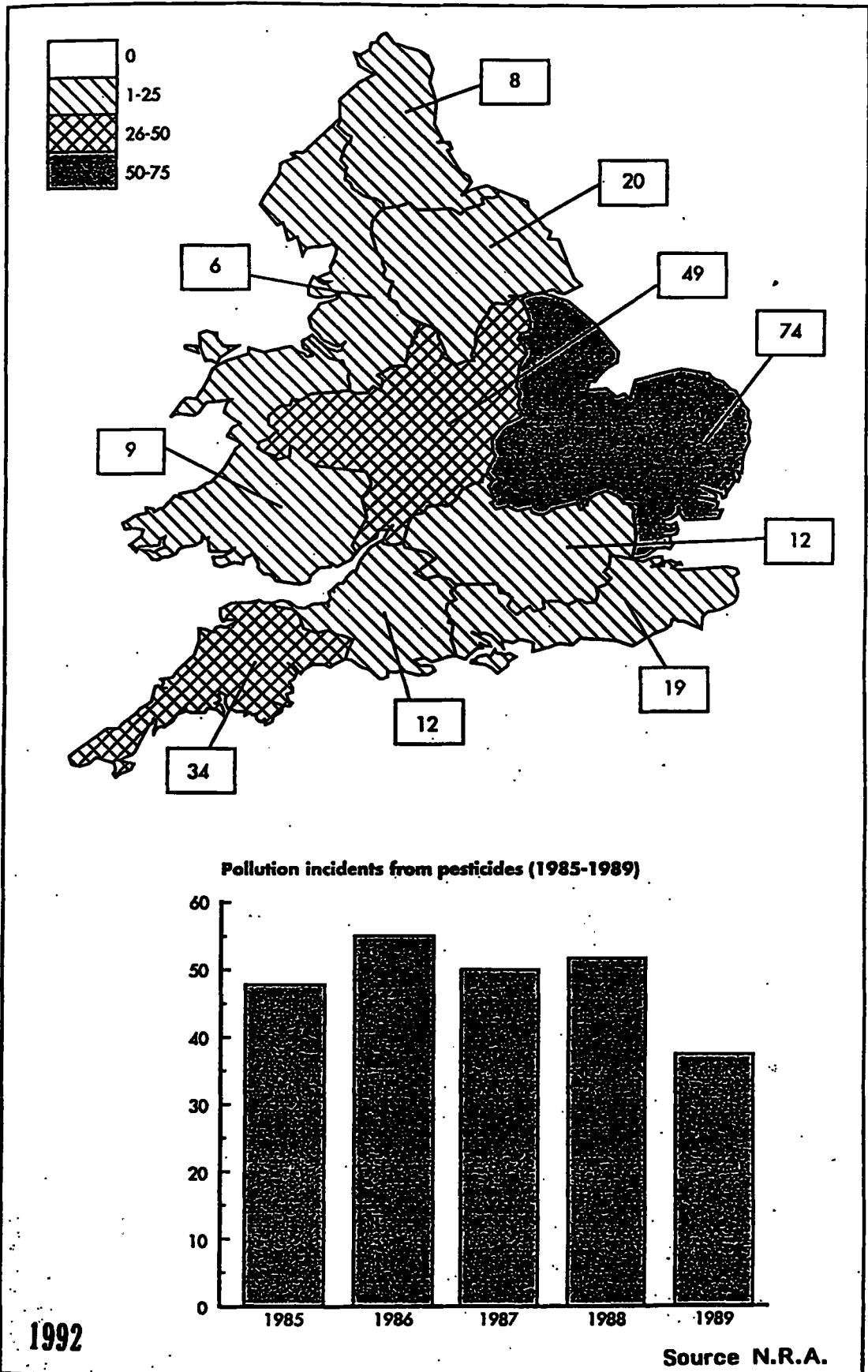


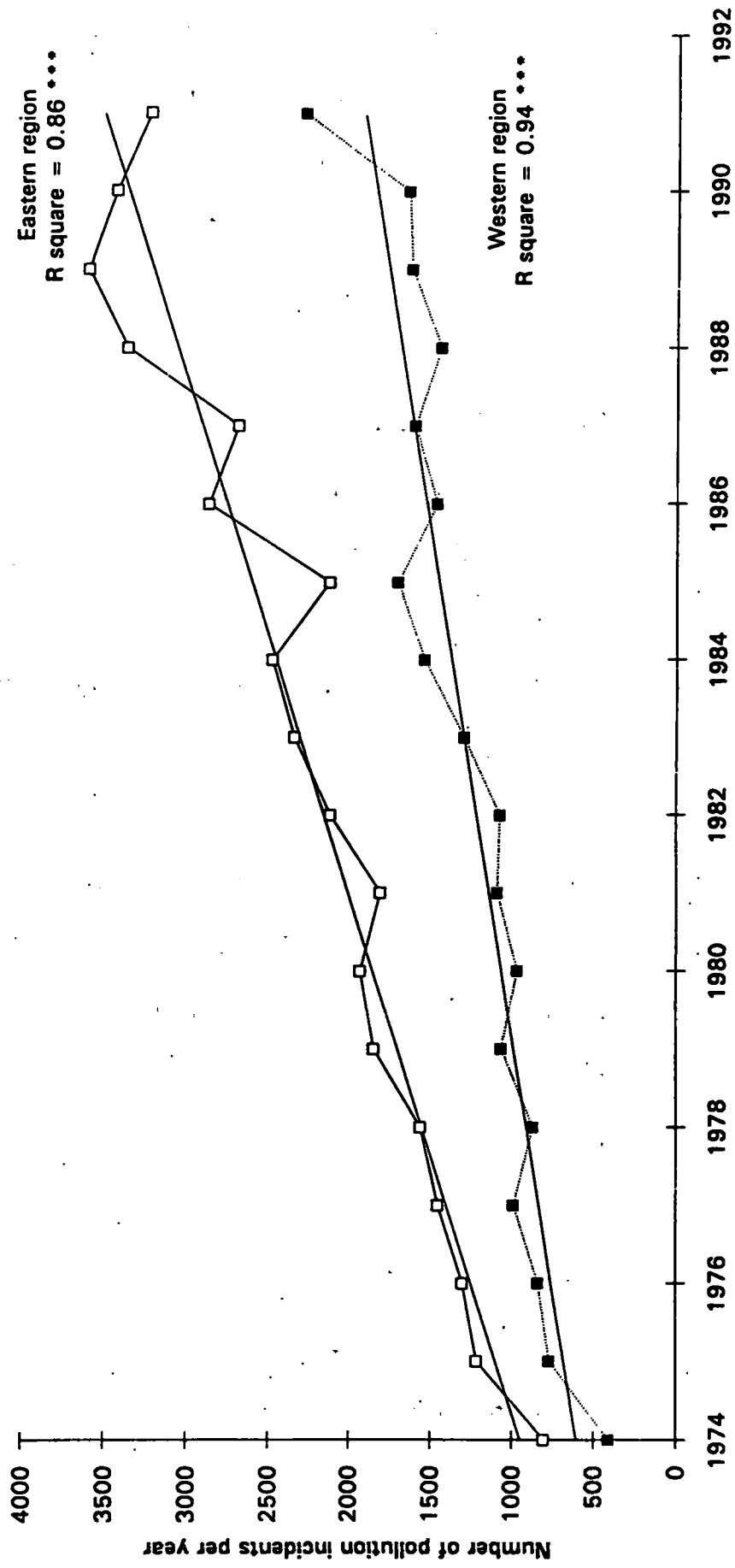
Table 8

Farm pollution prosecution trends - England & Wales

Year	NRA Region 1 (Western)			NRA Region 2 (Eastern)		
	Total inc	Major inc	Pros	Total inc	Major inc	Pros
1974	410	-	3	802	106	6
1975	769	-	-	1214	-	4
1976	837	-	-	1303	60	4
1977	989	-	-	1454	62	4
1978	870	-	-	1564	69	7
1979	1066	-	5	1851	109	8
1980	968	-	-	1930	89	-
1981	1095	-	24	1810	76	6
1982	1077	-	21	2120	53	5
1983	1299	66	19	2345	60	3
1984	1544	82	19	2486	53	5
1985	1707	58	22	2126	84	9
1986	1468	75	14	2880	138	12
1987	1605	n/a	32	2696	206	32
1988	1446	94	26	3374	171	37
1989	1627	7	15	3609	51	16
1990	1647	39	25	3441	22	37
1991	2290	15	48	3238	14	71

Source - NRA (1992)

**Figure 14 Regional trends in farm pollution incidents**



Source ,NRA 1992



for example constitutes a "farm pollution incident"? Does a longstanding farm effluent discharge, discovered on a routine visit count as an incident? This is the type of anomaly that causes bias. The correct definition of a "farm pollution incident" should perhaps be that which causes deleterious effects in a flowing watercourse and is not a discharge of longstanding, known to the Authorities, having little environmental impact.

The variation between geographical region in types of incidents certainly exists, but equally important is regional bias between NRA and MAFF areas hidden within the statistics (WRC 1979). Categorisation of incidents according to type should be so specific and unequivocal, in order that interpretation and conclusions can be accurately drawn, if guidelines are correctly followed.

The errors in the statistics must be considered in the context of this being the only UK source of such statistics and therefore they form the important basis for changes in approach and strategy by various authorities. They consequently form a valuable management tool for many environmental bodies.

#### **2.4 Influences on agricultural statistics**

Climatic factors can be directly related to seasonal pollution statistics and meteorological data can be used to predict potential problem situations arising, and therefore appropriate pre-emptive action advice can be given.

Examples of this connection can be seen in years of extremes of climate (see Fig's 15 & 16), for example in 1985 a summer with above average rainfall resulted in wetter than normal silage with consequent increased silage liquor production (ADAS/WAA 1985). It can be seen that numbers of silage incidents increased during that year. Problems arise when liquor tank capacity cannot cope with abnormal volumes and the associated dilemma of having to dispose of these liquors on to saturated grassland with consequent runoff. It could be argued that increased rainfall gives extra dilution and minimises the polluting effect. Discussion with Pollution Officers reveals that in most cases the watercourses only increase in flows for short summer periods following rainfall, whereas the effluent discharge will often be continuous through the drier periods. High strength discharges such as slurry and silage effluent will in any event not significantly be diluted below chronic effect, by short duration summer storms.

In 1989 an analysis of monthly rainfall by MAFF revealed a particularly dry spring with excellent conditions for slurry spreading and a low moisture content silage. Whilst it was ideal in many ways, it was noted that when incidents were detected, the effects were more acute than usual, since low river flows resulting from the dry weather gave less dilution for this chronic pollutant.

Another example of climatic influences on statistics occurred in the period 1987/88 when above average rainfall resulted in slurry management systems

**Figure 15 Farm Pollutions and Rainfall Association**

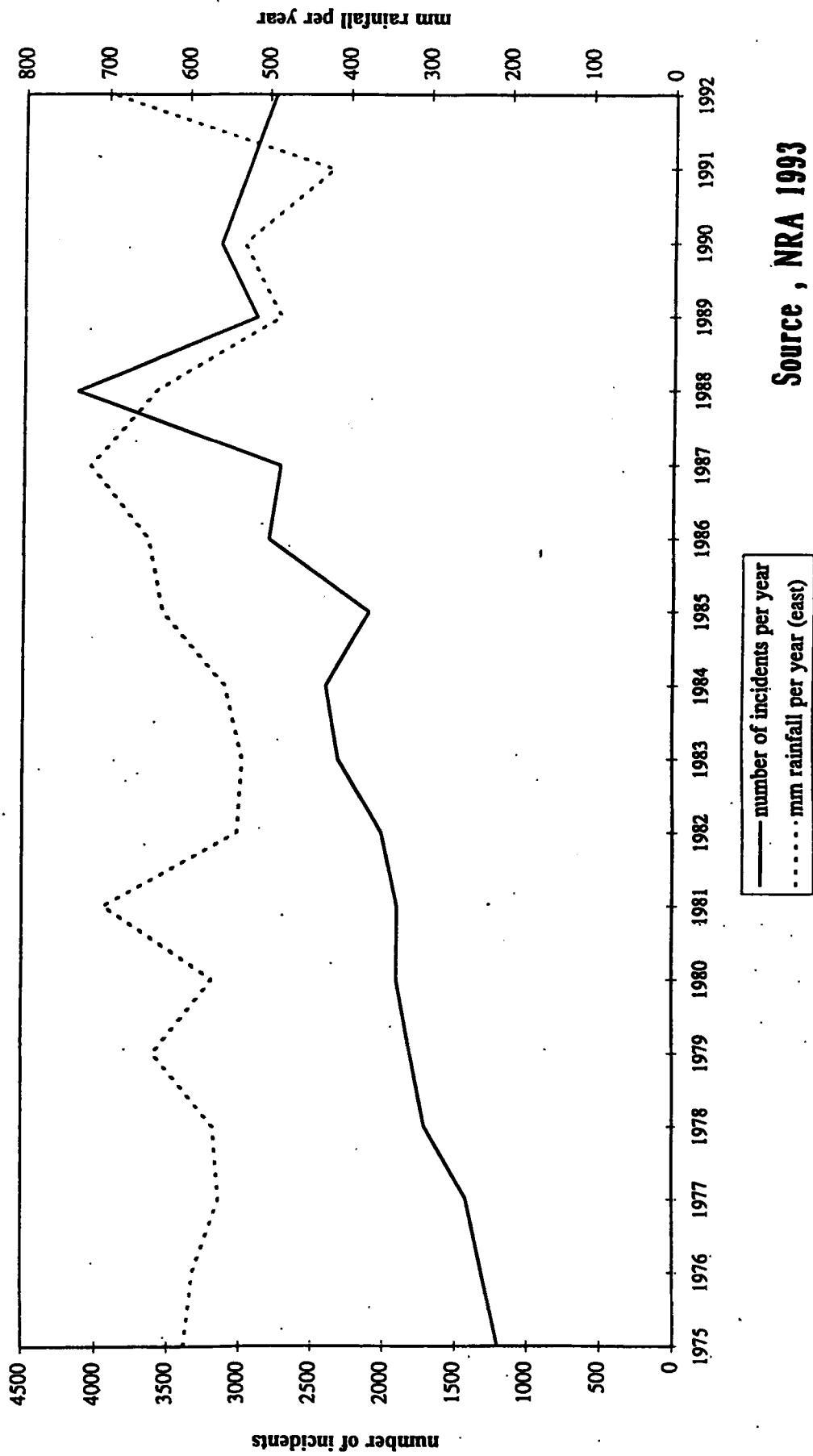
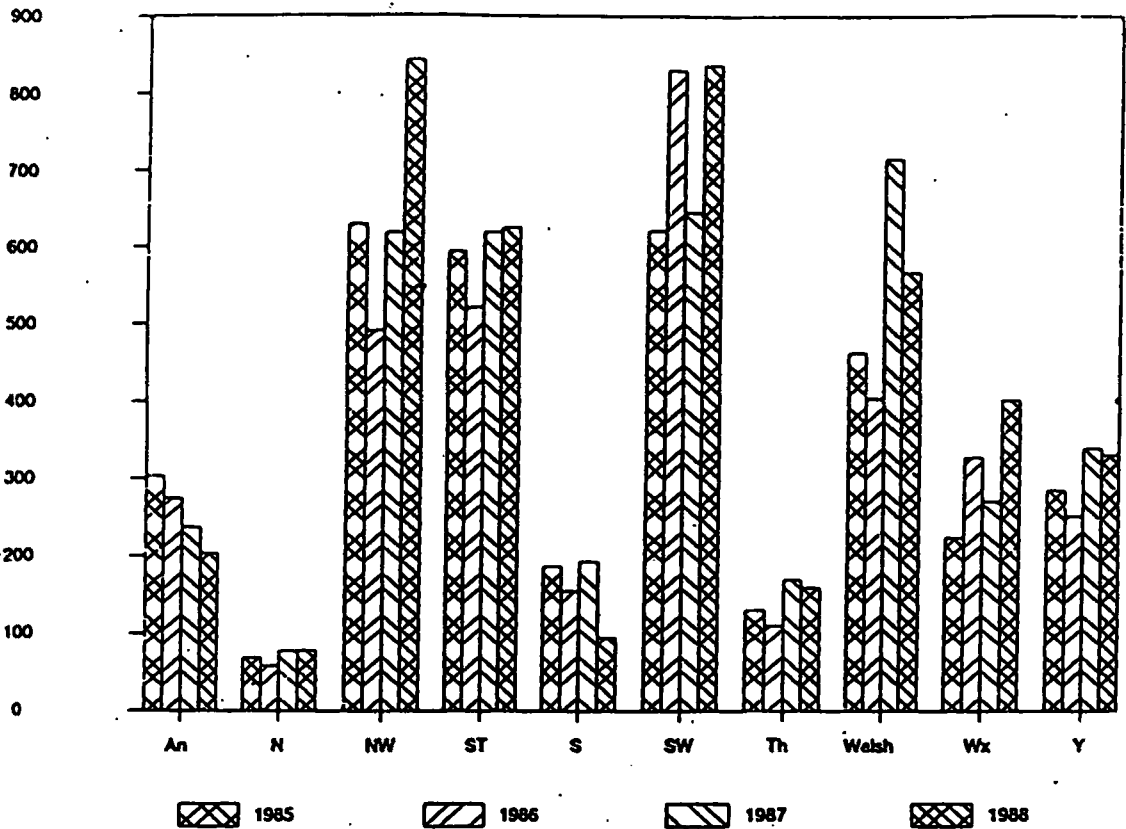


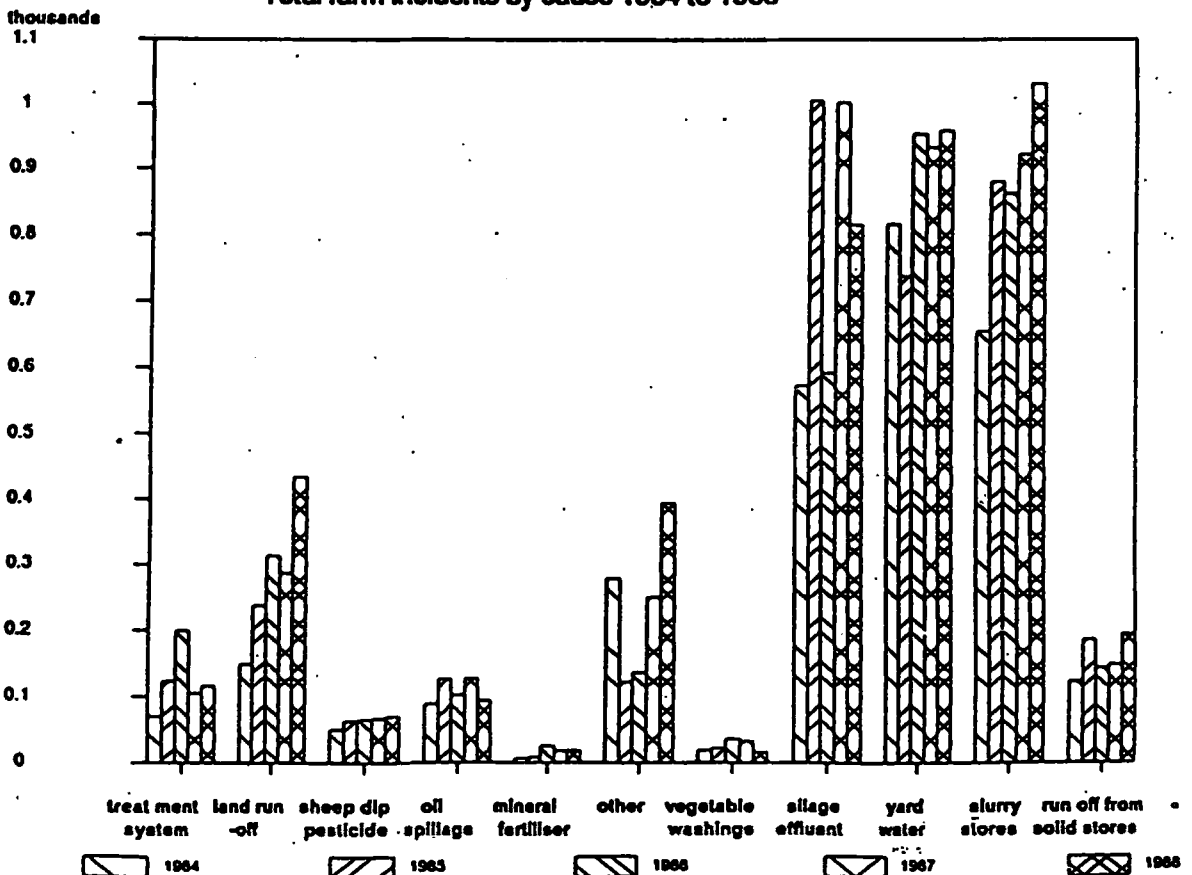
Figure 16

Total farm incidents 1985 to 1988 by water authority



MAFF/WAA 1988

Total farm incidents by cause 1984 to 1988



being overwhelmed particularly in piggery areas such as East Anglia and Yorkshire (see Fig's 16). The effect on the 1988 totals of recorded incidents was that 99% of that total came from the wettest counties in England at that time. In the later part of 1988 a subsequent dry period resulted in a dramatic reduction in incidents.

Trends in farm incomes and diversity indirectly affect the statistics since the tonnage of waste to be disposed of and the capital available for disposal systems are important factors (see Fig 17) (NFU 1984).

The trends towards self-sufficiency in UK had lead to considerable increases in numbers of cattle, pigs, sheep, lambs and poultry kept in the period between 1930 and 1985 (see Fig 18). This follows the trend of the rising number of pollution incidents and is important as shown on the graph (figures 6 & 18) with both statistics showing similar rises. Examples of the scale of increase can be seen in that the pig population of UK rose by some 220% between 1950 and 1985. What also occurred during this period was a movement away from diversity of pigs around many farms to a concentration on a small number of specialist units, thereby concentrating the acute pollution potential. A similar specialist trend was evident in the poultry, cattle and sheep industries (MAFF 1989).

Net farm incomes have fluctuated for a variety of reasons including those connected with subsidies and world price structures, with a general downward

Figure 17

Indices of net farm income in real terms  
by farm type (1982/83 = 100)

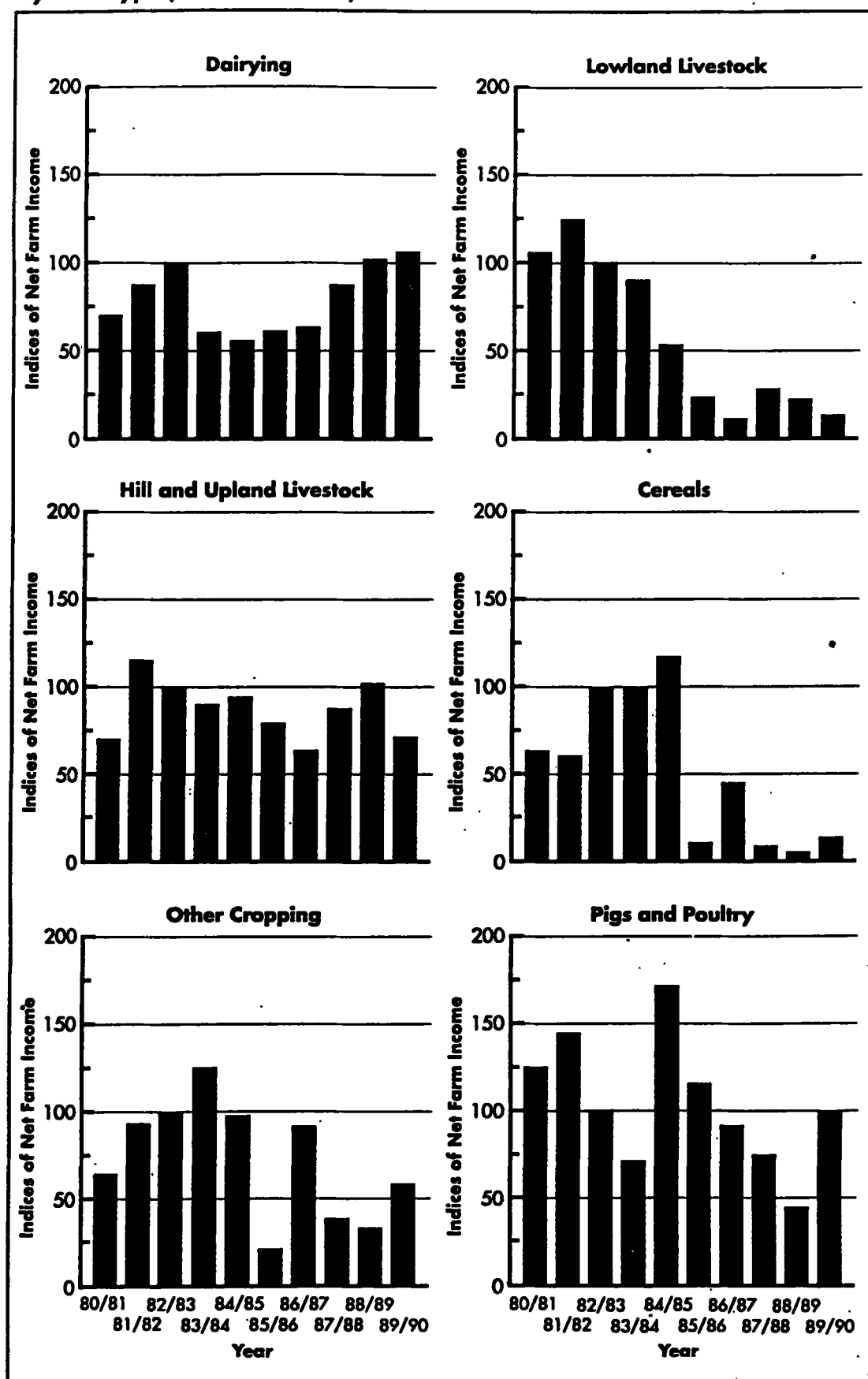
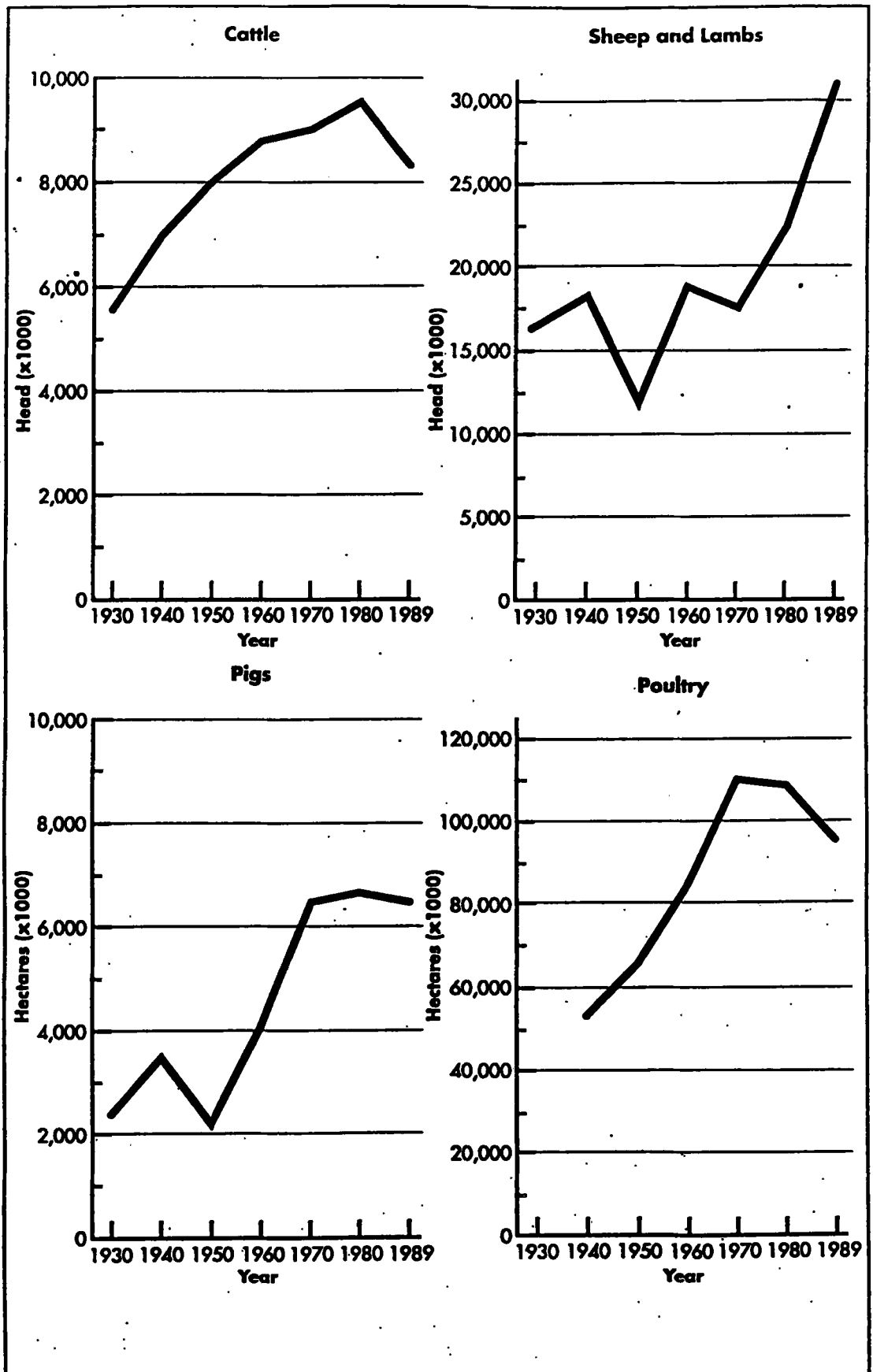


Figure 18

Total stock numbers in England and Wales



trend (NRA 1992). Farmers have tried to counteract this by increasing unit sizes of pigs and poultry, yet unfortunately net farm income dropped dramatically during the period 1985 - 1990 for other reasons. Interviews with MAFF and NRA Officers reveal the typical scenario to be that of pollution incidents arising from expanded livestock holdings, corresponding with a reduced income to spend on much needed pollution prevention measures. The only exception to the decline in incomes has been the dairy sector where a modest increase in income during the period 1986 - 1992 was apparent. The trends for incidents associated with slurry stores, yard water and silage effluent from dairy farms show some improvement since the early 1980's (see Fig 6) (NRA 1992). A direct connection cannot be seen, although it has been the experience of field officers that medium and large dairy units had capital from farm income available for pollution prevention schemes, that was not always accessible to piggery and poultry farmers. Other factors are also involved such as milk quotas, that are reducing numbers of smaller uneconomic dairy holdings. In addition relative loadings of waste produced from a typical dairy unit are lower than piggery units and consequently a more manageable disposal problems exists, particularly in the summer months (Bascombe et al 1990).

The economics of farming during the period since the second world war has been very cyclical, with a general decline in incomes (see Fig 17). Against this trend the introduction of tighter environmental controls has led to a need for expenditure that could not be generally afforded. The consequence has

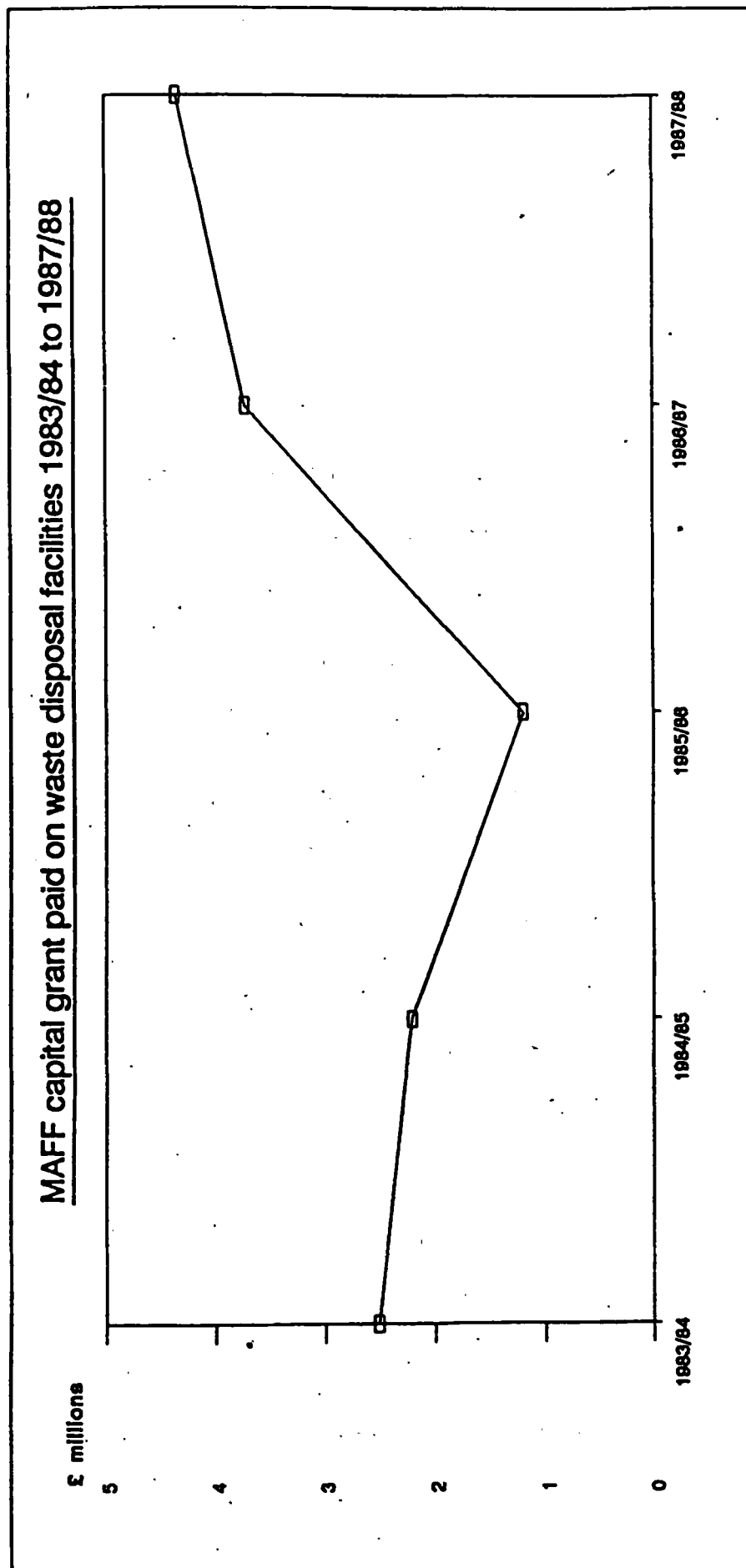


been that some farmers have continued with inadequate effluent systems with resultant river pollution ensuing.

Grant Aid availability for farm effluent schemes is a considerable incentive in times of low farm incomes. Although it has varied over the years (see Fig 19), it reached its highest ever level at 50% in 1989 but has in 1993 been reduced to 25% with potential detrimental consequences. The grant is however only eligible on fixed plant such as lagoons, pumping systems, and drainage. Criticism has been raised in respect of lack of grant aid availability for essential mobile plant (Davies 1993) such as low rate irrigators, which are necessary for adequate low rate disposal on heavy land. The counter argument is however that such items can be moved from farm to farm. Criticism is also suggested in the context of such grants being used to partially finance farm expansion and improvement. Although this is in part a correct criticism, organisations such as MAFF have little alternative but to administer schemes in their current form. The essential point of the argument is that any farm effluent scheme has no payback for the farmer (apart from a small quantity of nitrogen) and therefore it requires an incentive to initiate a scheme.

Figure 6 shows agricultural farm pollution incidents peaked in 1988 and since then have declined between 12% and 15%. In 1988 the grant aid scheme was changed with effect from November of that year. The new scheme replaced the Agricultural Improvement Scheme and introduced 50% grant with the specific aim of improving the environment. The new grant for slurry and

**Figure 19**



silage effluent storage, treatment and disposal included fixed disposal pipings and safety fencing on waste storage facilities. With the grant taking effect on 20 February 1989 and the downturn in pollution incidents also occurring in 1989 it could be argued that this was a contributory factor. The factors involved in 1989 were that, principally it was a very dry year, the 50% grant aid became available and the NRA was formed, with a considerable deterrent effect. Total farm waste incidents (UK) that year were 2500 compared with 3500 in 1988. However the take up rate for the new grant scheme was high in comparison with the old Agricultural Improvement Scheme (Davies 1992). Provision was made for £50 million over three years in comparison with only £17 million spent during two years under the old scheme.

To maintain the downward trend in pollution statistics, it is essential to keep the grant aid system to meet modern financial requirements of environmental protection and NFU officials have suggested that aid should be extended and upgraded. In particular, they suggest that separation schemes for clean and dirty water should be eligible for grant, thereby reducing the volume of dirty water that has to be collected and disposed (See Fig 19).

In the medium term the environmental aims of substantially reducing pollution incidents and river pollution will result in a need to continue to give substantial grant aid, if the required investment in pollution control is to be achieved, that will then bring about changes in agricultural practises. Organisations such as MAFF and NRA must however demonstrate that new

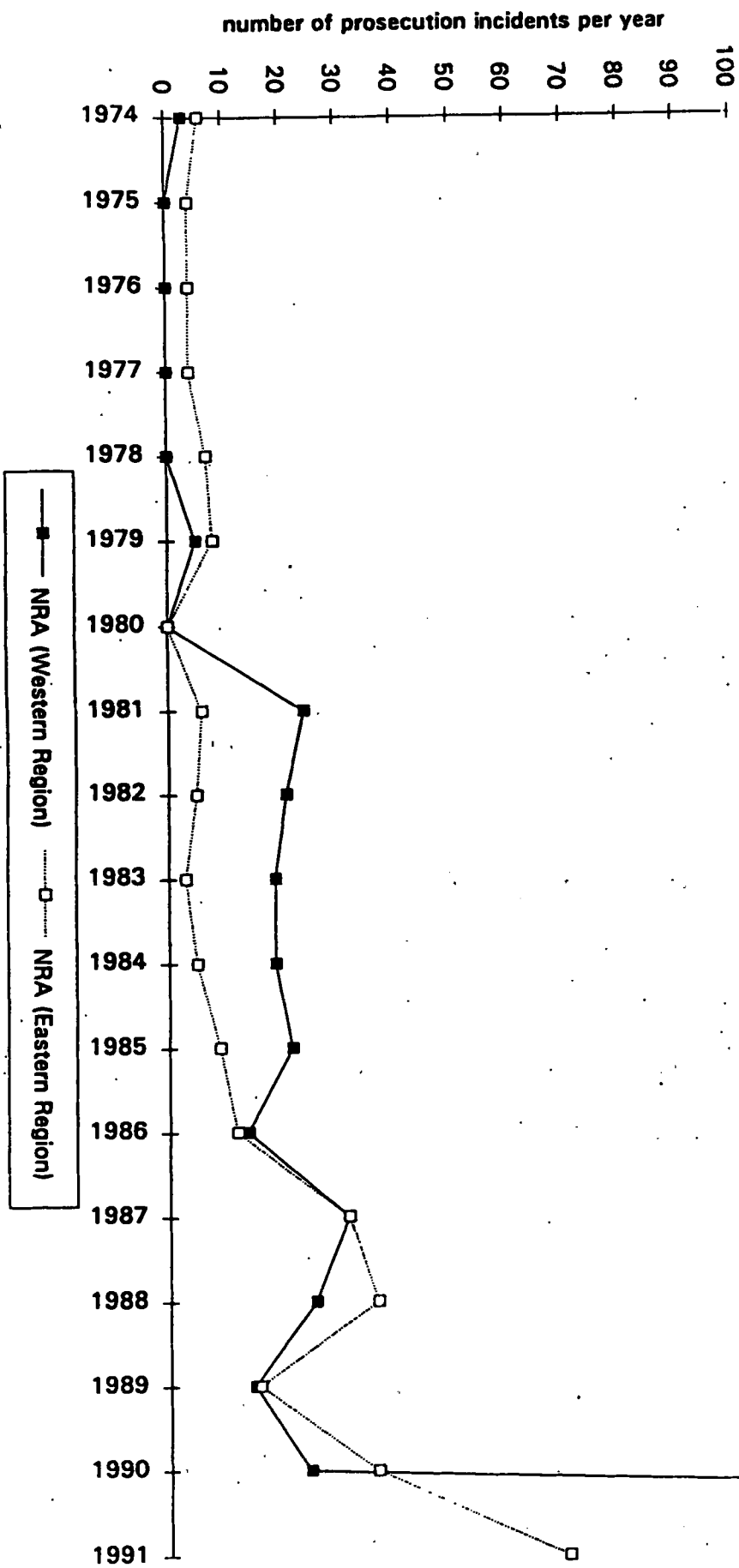
rigorous statutory requirements are essential and have a positive cost benefit to the environment in practise (NRA 1992). They should not be perceived as having an ultra cautious/over design approach, that unfairly penalises sections of agriculture. Such governmental protocols could result in unnecessarily large sums of grant aid being paid, with little environmental benefit?

The influence of legislation and consequent prosecution policy on farm pollution statistics may be important, yet it is not easily defined (see Fig 6) since interrelated factors cannot be separated in their significance.

Statistics of numbers of prosecutions taken against the agricultural community on a yearly basis show a similar related pattern in the period up to 1989 (see Table 8 and Fig 20). Fluctuations in the statistics have been attributed to weather extremes and changes in livestock husbandry techniques during this period. Since 1989 the table shows that the policy of NRA in prosecuting offenders is developing significantly, although regional differences are still apparent for this national organisation. A dramatic rise in all regions prosecutions was particularly noticeable in 1991 (NRA 1992).

Legislation introduced over the last two decades is likely to have a deterrent effect, but subsequent interpretation and implementation policy by the authorities remains the basis for the proportion of prosecutions being taken under the appropriate Acts of Parliament. In 1985 the major operative clauses of Control of Pollution Act (1974) Part II came into effect and farm

Figure 20 Regional trends in farm prosecutions



NRA 1992

prosecutions came under the terms of the Act. The important provisions included higher maximum penalties (£20,000) and for the first time a defence that they were following "good agricultural practice" was allowed. In practice however it is unlikely that if good agricultural practice is followed, any significant pollution will result.

NRA now controls pollution in the UK as a government agency and prosecutes principally under the provision of Part III of the Water Resources Act 1991. What is not widely understood is that prosecutions could and have been taken against farmers for serious offences for over one hundred years (Robertson 1977). Part I of the 1876 Rivers Pollution Prevention Act made it an offence to "put or (cause) to be put or to fall or knowingly (permit) to be put or to fall or to be carried into any stream so as to interfere with its due flow or to pollute its waters".

The current legislation is basically covering the same aspects as that detailed in "Victorian" language in the 1876 Act and the same basis for prosecution has always existed. What has altered out of all recognition since 1876 is the status and size of enforcement agencies, as they police the requirements for unpolluted rivers, increasingly utilised for abstraction. Prior to 1950, pollution control duties were a minor part of local authorities, public health duties. Since 1950 the UK has had a gradual build of "purpose specific" river/water authorities. The increasing population of UK has resulted in multiple users for all our freshwater rivers including public water supply.

This factor together with the trend towards large intensive livestock units has meant that we now implement legislation that historically was not utilised, except on rare occasions. It is postulated however that in the first half of this century pollution from diffuse sources on farms caused significantly more damage than those still operating today in the UK? (Robertson 1977).

The legislation described above was principally used as a tool to control pollution and as a pollution prevention measure. By contrast the Control of Pollution (Silage, Slurry and Agricultural Fuel Oil) Regulation 1991 aims to prevent pollution by setting minimum standards for keeping and handling these substances. The improvements to farms will only be seen in the medium to long term since existing facilities will be exempt, although the NRA may require improvements if there is a risk of pollution at an existing farm. New or substantially enlarged (greater than 15%) or reconstructed facilities must comply with the construction and design standards set out in the Regulations, and farmers must notify the NRA before bringing such facilities into use. Compliance with the Regulations is not a defence, unlike the Control of Pollution Act, but it may be a mitigating factor. The aim of these Regulations has been to specify the level of construction and performance required to minimise the risk of water pollution (see Appendix 4). The primary aims of the Regulations is to reduce the number of farm effluent pollutions. However the NRA must be seen to administer the Regulations in a fair and consistent manner without prejudicing the economics and viability of a enterprise unnecessarily. It is anticipated that by the end of the century, the Regulations

will have had a significant impact on livestock holdings (MAFF 1991b).

In conclusion it can be seen that the factors influencing farm pollution incident statistics are multiple and although on an annual basis one factor sometimes predominates, it is still a combination of all the aspects detailed above that contribute to the complex trends (see Fig 6). For future planning, much can be learned of the long term trends that can follow major external changes or significant natural events.

Examination of pollution statistics reveals some general trends which show a general improvement over the last decade. However when examined against important associated factors, such as grant aid changes, new legislation, etc no direct association can be established. The most significant factor causing fluctuations in pollution statistics seasonally are weather problems, and specifically rainfall.

The original pollution statistics hypothesis must therefore be modified to state:-  
Agricultural pollution incident trends are linked to specific changes in new laws, grant aid and weather although no one factor always predominates.

River Water Quality although undoubtedly improved by elimination of farm effluent sources, is not directly correlated. Many interrelated factors also influence river water quality and biology and it is in most cases false to directly attribute it to farm effluent improvements. In totally rural catchments



this may rarely be proven, although areas such as East Anglia have many rural sewage treatment works that also affect water quality (Crook 1990).

A modified water quality hypothesis would be:- Many interrelated factors affect river water quality in agricultural areas and no one point directly influences it.

## **CHAPTER 3**

### **Farmers Attitudes Survey (Oral)**

#### **3.1 Introduction**

A need was identified early in this research to actually approach farmers to obtain first hand opinions and responses. No work has been undertaken in this area to date and opinions given by governmental authorities are often only a perception of farmers attitudes and not factual information obtained directly.

The need to establish from the farmers their attitudes in the areas of legislation, information sources, constructed works and attitudes led to the formulation of a written survey. However since the responses are limited in any written survey, a series of interviews and ensuing discussions took place to provide a greater depth of knowledge in specific areas of interests.

#### **3.2 Method**

The informal discussions took place with a cross section of livestock farmers and these have been recorded in field notes. The format of these discussions was not fixed since a more realistic response was obtained from a casual talk. The basis of my written questionnaire was memorised prior to the visit and the questions then raised in the course of a "chat". These informal discussions took with the farmers in my own locality, those approaching the NRA at work, at County Agricultural Shows, and on some occasions through "second hand" discussion with NRA colleagues. Approximately 40 interviews took place and although statistically this is not a viable number, the detail obtained has helped formulate conclusions.

### **3.3 Oral farm surveys - Results and Conclusions**

The vast majority of farmers do not have an unfriendly or unco-operative attitude towards the NRA. They appreciate that the NRA is committed to improving the quality of English rivers by controlling discharges from industry and agriculture.

Indirect criticism of the NRA often takes the form of questioning detail and the rationale of the regulation arising from the Slurry and Agricultural Fuel Oil Regulations. They often cite the problem of conflicting advice. Farmers believe (and perhaps rightly so), that advice from government departments, however varied, is co-ordinated and that contradictory advice should not therefore be given. In reality sections of government departments frequently have their own specialist areas of interest. Such specialist areas have their own regulations and guidelines that can be contradictory to other government departments. Jonathan Porritt in an environmental article in the East Anglian Daily Times (21.2.94) states "Government departments don't talk to each other about the aims of their 'green' schemes because they are more interested in protecting their pathetic little empires".

The farmers problem is not always immediately apparent since in meeting one set of regulations the farmer can inadvertently be in breach of others. One example quoted is that of a farmer constructing a farm effluent lagoon to stop discharges into a watercourse and the threat of pollution. Because of pressure to stop the pollution, the lagoon was constructed in the shortest time possible

and the relevant permissions and grants obtained from MAFF and NRA. However, because of the proximity to the local village, objections to it started, when it was filled with effluent. When the matter was raised with the local council it was discovered that planning permission was needed for any new lagoon constructed within 200 m of domestic habitation. The outcome of the legal deliberations is that a farmer now has a lagoon that he cannot use and needs to construct a second one on the same farm. This example illustrates the need to be aware of all the detail pertaining to a scheme. It is of course likely that many small farmers would not and will not be aware of such legislative detail (Mid Suffolk DC 1990).

Although quoted examples of disparity often involve the required size of effluent storage lagoons and pump sump capacity, this is because of the account taken of the ability to dispose of effluent on to varying soil types. Officers determining sizings can therefore arrive at different lagoon requirements depending on their judgement of the needs for effluent disposal. At the present no local appeal procedure exists against the judgement of MAFF/NRA in respect of their stipulations.

Examples from interviews show that the minimum of four months storage (MAFF 1991B) can be reduced on the judgement of the assessing officer, to as little as two months on light soils. Account is, on some occasions, taken of potential winter ground freezing for up to three months, other staff may ignore this factor.

Pump sump capacity at a minimum of two days retention is also subject to considerable variation. Some officers have passed schemes with minimal storage, as pump failure devices and portable tankering was available on that farm. Other staff never depart from the two day requirement.

Some guidance has been given by MAFF and DOE on these "grey areas". However variations in local interpretation will occur and have financial implications for those farmers involved.

Although from discussion with farmers it is apparent that they have sympathy with the aims of the NRA there is still a considerable lack of understanding of the strength and effects of pollutants. Silage effluent is widely publicised as being a strong pollutant capable of causing fish deaths and other farm pollutants such as Milk, Ammonium Nitrate, Pea Vining Liquor are as toxic to river life, yet the average farmer is unaware of this (Cousins 1993). The impression that comes across from many farmers is that these pollutants are unlikely to be as damaging to the environment as scientists state. For example a typical quote is "we were encouraged to put nitrogen fertilizers on to increase yield, but were not told it would get down into the water by ADAS, now farmers get blamed".

Table 9 shows the considerable diversity of opinion by farmers in respect of deleterious effects of organic farm effluents but an encouraging number (39%) gave silage as being amongst the worst farm pollutants (See fig 24). This

awareness problem could perhaps, be overcome by increasing publicity when pollution occurs from these unusual pollutants and carefully explaining the detrimental potency of the pollutant. Detailed explanation of pollutants and impacts is an area in which NRA should be more pro-active in.

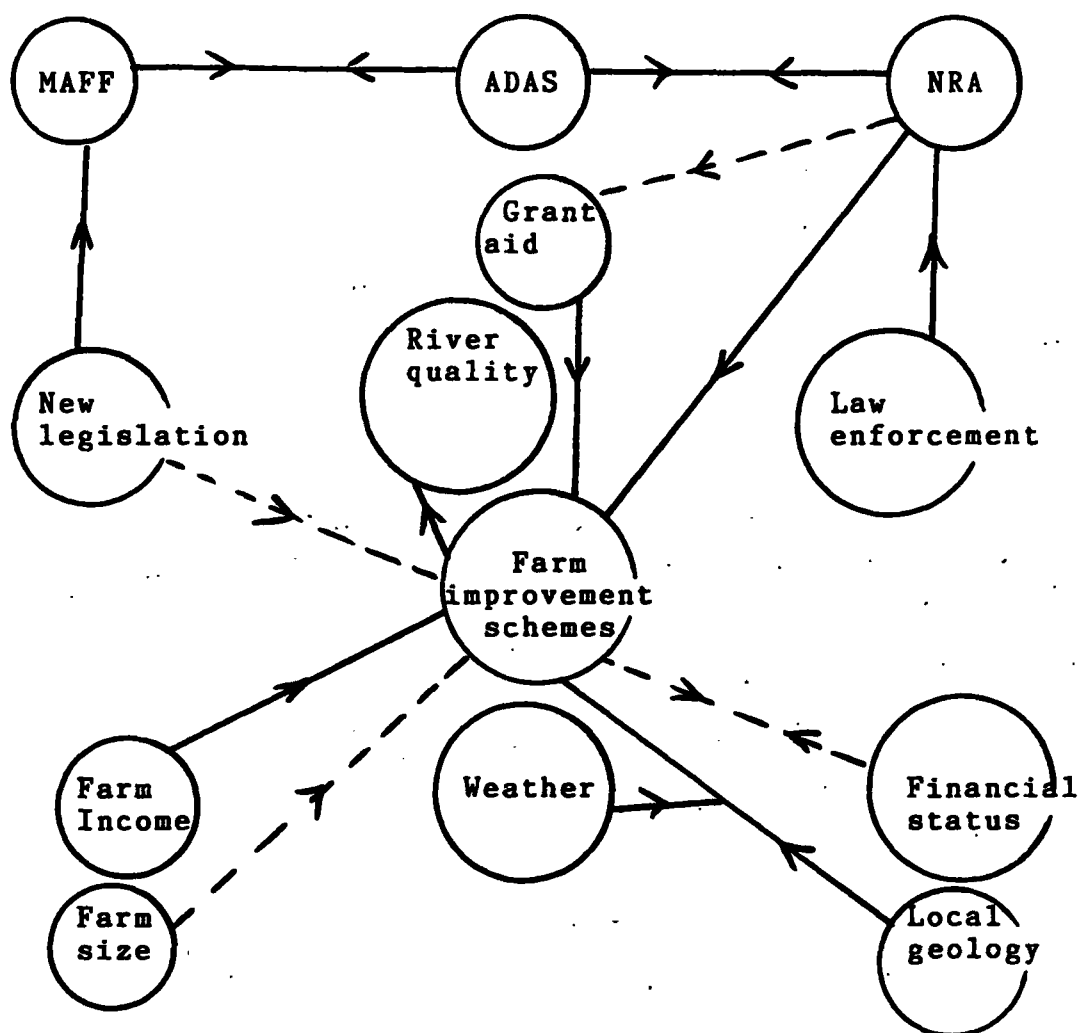
Another important point from the interviews with farmers is in respect of their attitudes to the NRA. Unlike its predecessor organisations, the NRA has portrayed itself as an organisation with a policy of rigorously enforcing the law. The result is that farmers now feel they are in confrontation with the NRA and that the organisation does not provide advice or assistance. The reality is, perhaps, that the agricultural community has always been suspicious and intolerant of government departments (Davies 1993). This situation may never change, since governmental departments and EU are deeply involved in the profitability of farms through continual changes in subsidies paid to them, however, the NRA Officers have an advisory role towards the farmers, in assisting them to prepare details of farm effluent schemes. Farmers are suspicious of inviting NRA Officers on to their farms to advise on details of a new scheme if the NRA could potentially find a grossly polluting (Long 1992) discharge that could be the subject of subsequent court action. A series of modified hypotheses were developed after the investigations and these are the basis for subsequent discussions (See Fig's 21, 22 & 23). At the present time the management of NRA have not made a clear distinction between enforcement duties and those of an advisory and assistance role. It would seem that these areas should be clearly separated if the present

**Table 9 Farmers responses re polluting effect of farm pollutants**

No of responses	1st	2nd	3rd	4th	5th
4	Silage	Slurry	Oil	Sewage	Milk
1	Silage	Milk	Slurry	Oil	Sewage
2	Slurry	Silage	Oil	Sewage	Milk
3	Milk	Silage	Oil	Slurry	Sewage
2	Sewage	Silage	Slurry	Oil	Milk
2	Slurry	Sewage	Silage	Oil	Milk
2	Oil	Slurry	Silage	Sewage	Milk
1	Sewage	Oil	Silage	Milk	Slurry
1	Sewage	Oil	Silage	Slurry	Milk
1	Sewage	Milk	Slurry	Silage	Oil
3	Silage	Slurry	Oil	Milk	Sewage
1	Oil	Sewage	Milk	Slurry	Silage
5	Oil	Silage	Sewage	Slurry	Milk
2	Silage	Sewage	Oil	Slurry	Milk
1	Slurry	Sewage	Oil	Silage	Milk
1	Oil	Sewage	Slurry	Silage	Milk
1	Silage	Oil	Milk	Sewage	Slurry
1	Oil	Silage	Sewage	Milk	Slurry
1	Sewage	Oil	Slurry	Silage	Milk
1	Milk	Silage	Slurry	Sewage	Oil
1	Milk	Silage	Slurry	Oil	Sewage
1	Slurry	Silage	Sewage	Oil	Milk
1	Silage	Slurry	Sewage	Oil	Milk
1	Milk	Oil	Slurry	Silage	Sewage
1	Silage	Milk	Oil	Slurry	Sewage
1	Silage	Oil	Slurry	Sewage	Milk
3	Silage	Oil	Sewage	Slurry	Milk
1	Sewage	Silage	Oil	Milk	Slurry
1	Milk	Oil	Silage	Sewage	Slurry
1	Silage	Slurry	Milk	Oil	Sewage
<b>Suggested Order</b>	<b>Silage</b>	<b>Slurry</b>	<b>Milk</b>	<b>Sewage</b>	<b>Oil</b>

**Figure 21**

**Modified Hypothesis - Water Quality and Agriculture**



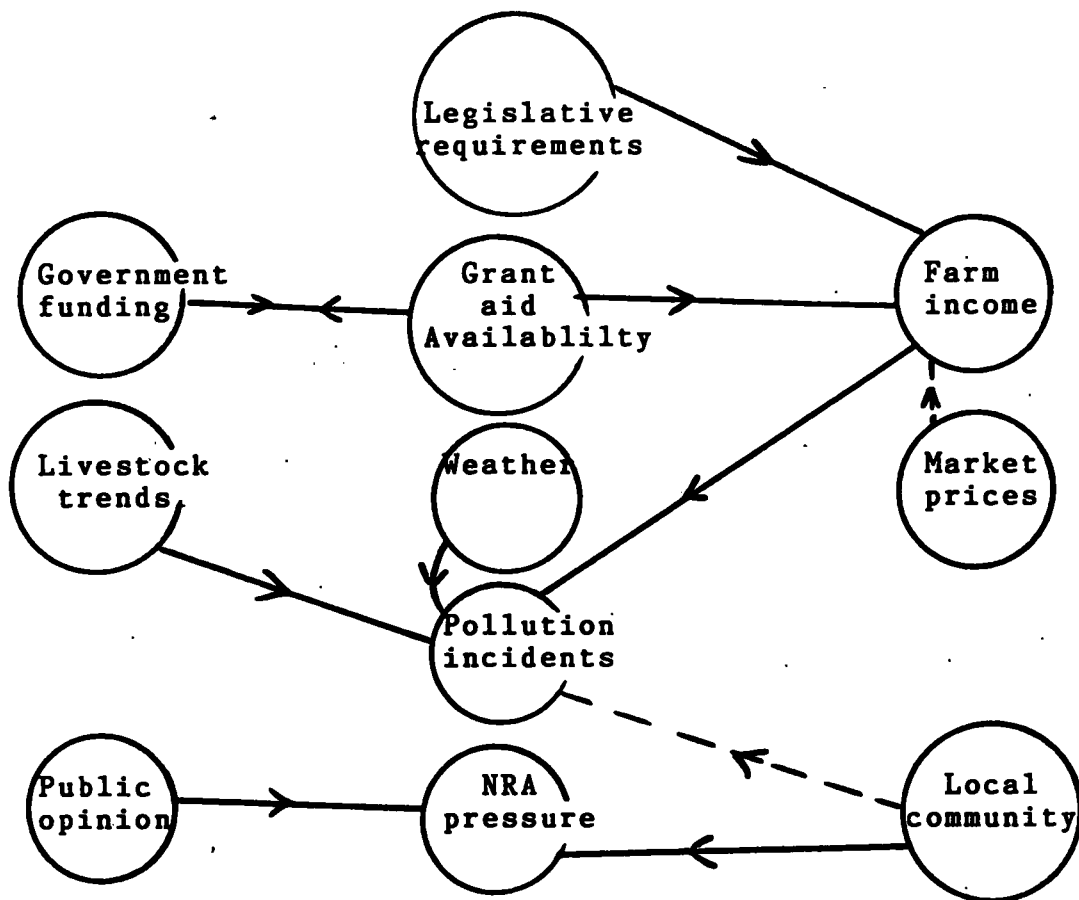
**Statement - Many interrelated factors affect river water quality in agricultural areas and no one point directly influences it.**

**Note - Arrows indicate influence paths and links between elements (solid lines). Broken lines show indirect influences.**



**Figure 22**

**Modified Hypothesis - Pollution statistics**

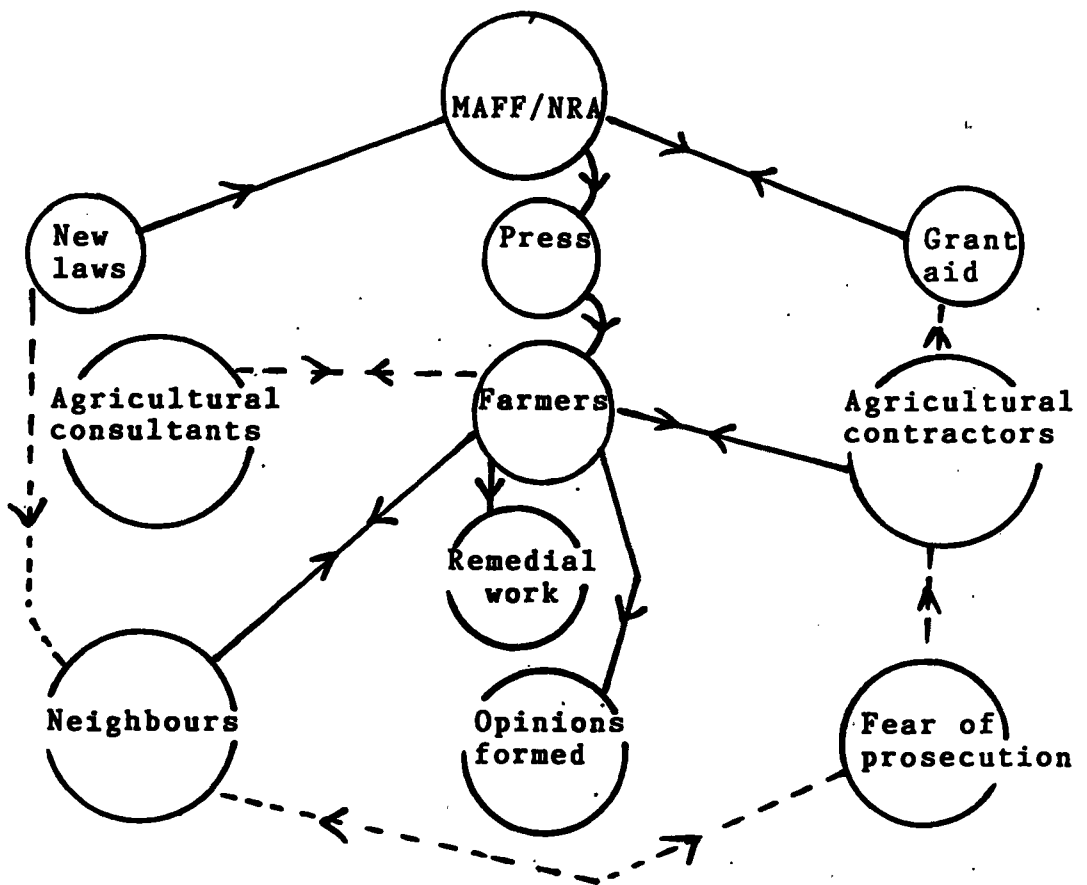


**Statement - Agricultural pollution incidents are linked to specific changes in new laws, grant aid and weather although no one factor predominates.**

**Note - Arrows indicate influence paths and links between elements (solid lines). Broken lines show indirect influences.**

**Figure 23**

**Modified Hypothesis - Farmers attitudes and actions**

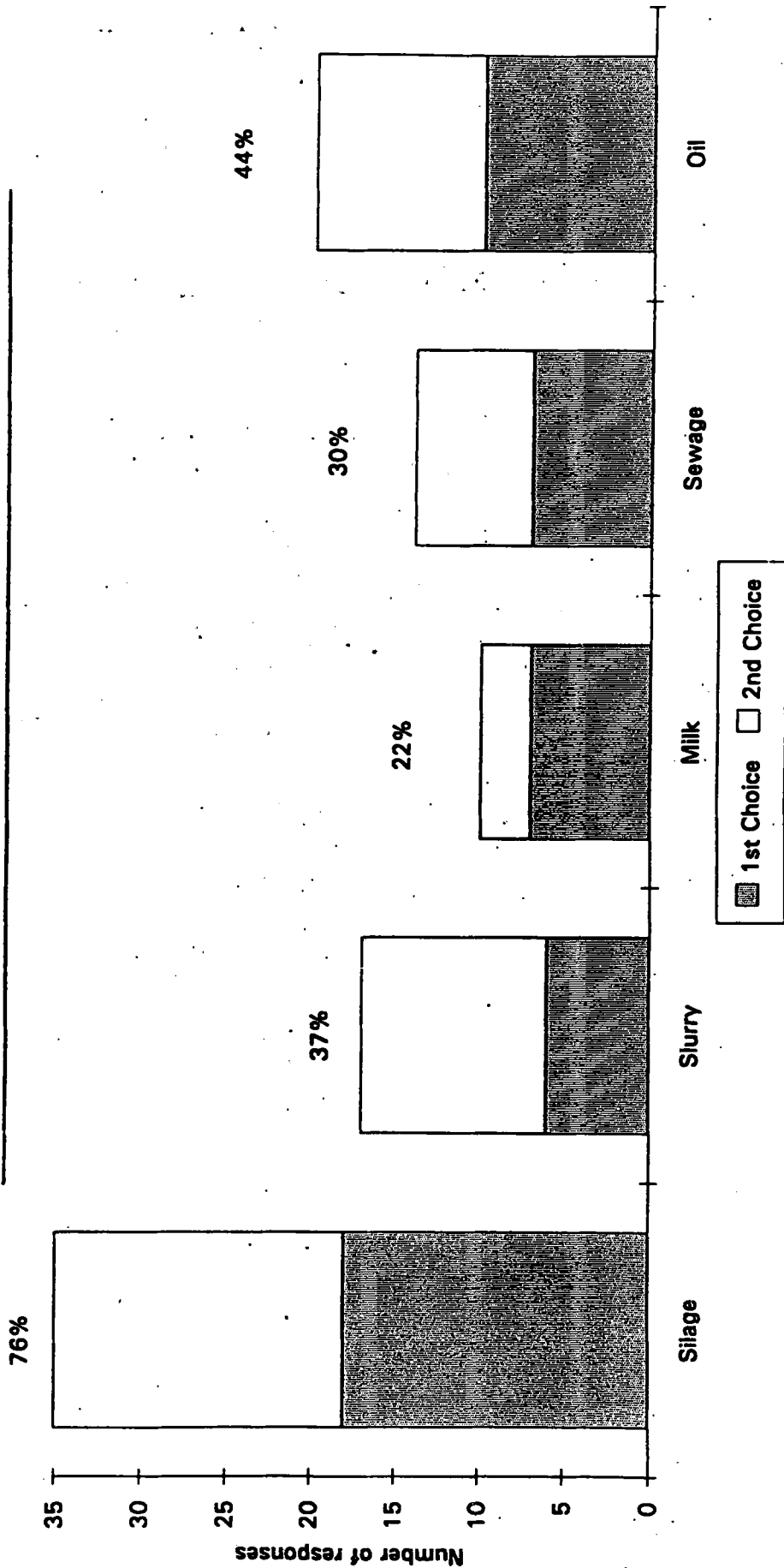


**Statement - Farmers are significantly influenced by the farming press and neighbours.**

**Note - Arrows indicate influence paths and links between elements (solid lines). Broken lines show indirect influences.**

**Figure 24**

**Farmers' perception of the most polluting impact of five organic contaminants**



Nov. 1992 test

anomalous situation is to be rectified. An example of the contrary nature of NRA in this respect is, the NRA officer who has taken a prosecution against a farmer for serious river pollution. Shortly afterwards the same officer may be expected to offer hospitality, and general friendly advice to the same farmer, at the annual County Show.

The solution to this type of embarrassing situation may be to dedicate an enforcement section to prosecution work, and ensure these particular staff are never put into a situation where they are expected to give advice or general assistance.

Another area of concern to farmers is the effect of the weather on their control of effluent disposal. Examples were given during interviews where farms had been subject to abnormal amounts of rainfall, or equipment failures, following storms, which resulted in effluent being discharged into a watercourse. The farmers argue that no containment scheme can cater for every contingency, and consequently, prosecution following these unusual circumstances is unfair (Long 1992). The drainage system within the farm complex can be beaten in cases where exceptional storms overtop farm drains, and causes effluent to enter watercourses. In some circumstances this type of pollution may go undetected, since periods of prolonged rainfall may result in considerable dilution in the watercourse, before the effluent discharge occurs. Rainfall problems are common (see Fig 15) and I quote a farmer who had irrigated effluent on to heavy land at an acceptable rate. However an

unexpected heavy shower caused runoff through the land drains and fish deaths in the nearby river. Prosecution by the Water Authority was attempted but did not proceed since the evidence had disappeared in the heavy storm.

**Significant points arising from discussions:**

- a) Farmers are still suspicious of NRA's ability to give assistance and remain, at the same time, an enforcement agency.
- b) Concerns have been raised in respect of anomalies in implementing legislation.
- c) Farmers have little detailed knowledge of the effects of farm pollutants.

## **CHAPTER 4**

### **4.1 Introduction**

Early in this study it was concluded that to obtain a representative number of survey responses a written questionnaire would need to be prepared. The logistics of conducting 250 oral interviews was considered to be formidable and also personal bias and dislike is avoided if a written questionnaire is used.

It is believed that nobody has specifically investigated, in an unbiased way, the attitudes and actions of the farming community in respect of environmental controls and their effects. Normally (Tait 1988) such questionnaires are targeted by feed manufacturers, machinery or chemical distributors or government departments such as MAFF.

The written survey is the central part of this research investigation and has led to other areas of interest such as, the importance of the agricultural press in disseminating and formulating ideas to the farming community.

The questionnaires were built on traditional patterns, (Whyte 1977) although the second and third versions were developed and refined in the light of findings from the initial survey.

Although conclusions given have been drawn from utilisation of all the response data, individual questionnaires are quoted since a relationship

between responses for individuals can be seen. These trends are hidden when grouping the data together.

## **4.2 Methods**

### **4.2.1 Questionnaire makeup and design**

The makeup of the questionnaire was based on a number of principle topics of specific interest:-

**Legislation**

**Finance**

**Advice received**

**Attitudes to environmental agencies**

**Perceptions of problems**

**Information sources**

Initially a pilot survey was sent out in October 1991 (see Appendix 1) to twenty five farms known to me, using a preliminary questionnaire.

A second questionnaire was sent out in May 1992 (see Appendix 2), as a full scale survey, on a random basis to 250 farms.

This second survey was further refined and improved for a final survey of a different 250 farms in November 1992 (see Appendix 3).

All surveys were sent with an explanatory letter and a stamped addressed envelope. Timing of questionnaires was such that busy times, such as harvest, were avoided.

Questions were devised to probe the changes in attitudes and actions that have occurred on farms in recent years. Of particular interest were the effects on farmers of new organisations such as the NRA and the implementation of new controls such as the Silage, Slurry and Agricultural Fuel Oil Regulations (1991).

Prior to designing the questionnaire the theoretical aspects of question make up were examined (Cole 1990, Tait 1982, Tait 1988). It was apparent that a number of interrelated points are important if an unbiased and useful questionnaire is to be constructed.

As a preliminary to producing the written questionnaire it was established that asking questions to which responses are specifically directed generally takes less time per respondent than observing or listening to farmers freely composing narratives and descriptions. It was also believed that asking questions of people, provides information that could not be systematically observed, "such as questions on attitudes, feelings and beliefs".

In adopting a standardised approach to constructing a questionnaire the following theoretical aspects need consideration (Shephard 1989, Towler 1991)



- The need to obtain representative samples for quantitative analysis and statistical inference to larger populations.
- The literacy and familiarity of respondents with questionnaires.
- The confidence with which the researcher feels he can "precode the data and anticipate the categories of responses".
- Research questions and goals eg transitory "opinions" versus deeper seated values.

Detailed design of the questionnaire was based on papers by Whyte (1951), Selltiz (1959) in Whyte (1977), Webb (1966) in Whyte (1977) and Whyte (1977).

It was established that pretesting with a small number of respondents is almost always necessary in preparing a good questionnaire. It is not possible to see all the ambiguities, conflicts that difficult questions might produce, or to know all the alternative responses that should be included in closed questions. The first affects the reliability of the investigation and the second its viability.

Having gone through the preliminary questionnaire design, the main questionnaire should be constructed taking into account the following points:-

Logic - The questionnaire should have its own internal logic and consistency. Its structure and purpose may not be fully appreciated by the respondents but they should be able to see the "sense of it", or they will be confused and question the validity of it. Therefore questions should ideally flow logically

from one to another, and when a new topic or section begins it should be clearly identified.

**Information** - The respondent should be told at the beginning of the questionnaire something about its purpose, who is undertaking the research and if the results will be available to the respondents. The respondents should usually be assured of anonymity and be thanked for their assistance. In some cases, confidentiality of data obtained and reassurances of security of information will also be relevant.

**Clarity** - Instructions to the respondents should be uniform and unambiguous.

**Cross Checks** - The design should include questions which enable cross-checks to be made within different parts of the schedule or between the respondents answers and other external data.

**Overall Order** - Order within the schedule is important since there are sequential and time effects. Order may make the respondents attitude change and they could become wary, oversensitised, anxious to please or hostile. Difficult questions are therefore asked towards the end and open questions are asked before closed ones. In growing lists of events to rank or scale, there are systematic order-effects and biases. For example last ones recalled; right hand end of scale is more commonly used whatever its label; first ones mentioned in predominantly right-handed societies are more influential. These influences can be minimised by careful design.

**Length** - Ideally it should be as short as possible to achieve the desired outcome. The format should give the appearance of being easily and quickly completed by the respondent. In practise it has been found that if a

questionnaire takes more than 20 minutes to complete it is likely never to be completed. Account should be taken of the likely time available to your specific respondent group in completing the questionnaire. Time taken to complete it can be reduced by using simple "tick response" type questions.

Categories - In setting categories of question the results of initial surveys and pretesting should enable correct categories to be set. Some researchers in the area of environmental perception have argued that there is a strong rationale for enabling, as far as possible, the respondent to determine his own categories and to assign elements to them (Whyte 1977). However, because of the specificity of the questions used in respect of testing environmental hypotheses, it has been necessary to categorise the questions in an unidentified manner. Q-sorting has been used in the questionnaire to a limited extent, where the respondent is asked to arrange elements into sets. This is a more open way of obtaining the respondents own categories and the criteria used for dividing up the personal environment or areas of interest.

Closed Questions - In determining environmental attitudes from the farming community, closed questions have largely been opted for since they enable specific information to be determined without the possibility of a nebulous answer being given. Such questions, can require detailed responses of factual information or simply provoke a yes/no answer. When time is limited for a farmer to answer a questionnaire it is easier to respond to a given set of choices, rather than initiate or create an answer after due consideration. Closed questions usually simplify the situation. However, when one attempts to make the closed questions comprehensive, the number of options which

must be given can make the question so cumbersome that an open question becomes simpler to ask and easier to respond to. As a general rule, open questions are positioned before closed questions covering the same topics in order not to unduly bias the content of the open responses.

It can be seen therefore that in producing a questionnaire a great number of factors have to be taken into account. If bias is introduced, the conclusions and interpretation of the questionnaire will be flawed. The questioner should be aware of the need to obtain large samples for statistical analysis and inference to larger populations.

The questioner should, before undertaking the work, be able to precode the data and anticipate all the relevant questions and categories of responses. This should include, in respect of the farming community, an anticipation of their knowledge of such topics as legislation, environmental effects and mandatory requirements. Similarly all bias should be excluded from the questionnaire arising from the author's background and education. The farmer will almost certainly be alarmed by a governmental influence in a supposedly neutral questionnaire.

In formulating the questionnaire the ease of interpretation should be considered. Since the aim of such work is to produce quantitative conclusions from the responses following analysis, the questions must produce a result that is capable of some subsequent analysis.

#### **4.2.2 Response rates and distribution**

A random selection of East Anglian farmers were sent the questionnaire in the

counties of Essex, Suffolk and Norfolk. Consideration was given to targeting specific groups (such as FWAG) but after discussion with MAFF, FWAG, NRA and ADAS this was abandoned due to the confidentiality of information preventing release of address listings. In any event the responses given have enabled grouping of attitudes since farmers were asked which organisations they belonged to and what livestock holdings they had.

Throughout the target counties there are a variety of farming patterns from dairy units, intensive piggeries, to dedicated cereal farmers.

Consideration was also given to sending questionnaires to farms that have been visited by NRA, usually in connection with the discharge of effluent to a watercourse. Although this would have ensured that only livestock farms were targeted, the dilemma then is that using only "problem" farms gives a biased response.

Return rates of these questionnaires varied between 30 to 40% which is understood to be within the normal return rate (Whyte 1977). A small number of farmers took up the offer of a copy of the final dissertation. It was noted that these farmers were those with large acreages and also belonged to FWAG.

The initial trial was aimed at establishing if the questionnaire was of interest to the farmers and would consequently produce an adequate number of

responses. Twenty five were sent to farmers known personally to the author, and the response rate was twenty one. This rate of return was unusually high but is not unexpected since all of the farmers had effluent control systems and an interest in such matters.

The bias caused by this selection must be taken into account when interpreting this survey. However the major purpose of this survey was to refine the questionnaire in light of the responses, before the larger test sample was targeted.

The second and third surveys were both sent to two hundred and fifty farmers on a largely random basis throughout East Anglia. Much consideration was given as to how to target the appropriate section of the farming community. Although the principle aim was to target livestock holding farmers, it was considered that others could have an important viewpoint, since in all probability they would be, at the least, involved in application of nitrates and pesticides, in the absence of any livestock holding.

The population for the second and third surveys was confined to East Anglia since it would then correspond with the distribution of sites visited in the oral surveys. Attempts were made to obtain listings from MAFF of farmers involved in livestock enterprises. This information would not be released by MAFF under any circumstances although other sources were utilised such as Livestock Co-operatives, NRA records (not all polluters) and Yellow Pages

**Farm Listings.** Obviously certain regions of East Anglia have a bias towards particular types of farming and therefore a uniform spread throughout the counties of Norfolk, Suffolk and Essex was attempted. Since one of the areas of interest was the attitudes of farmers involved in environmental organisations, consideration was given to targeting a proportion of these farmers, those who belonged to FWAG for example. It was concluded that unnatural bias would be obtained if only FWAG members were targeted since they have positive environmental attitudes.

To achieve an adequate return rate the initial survey was sent in October 1991, the second in May 1992 and the final survey in November 1992.

Response rates were similar, with 71 in May and 70 in November 1992. At approximately 34% returned, this is in line with the normal questionnaire numbers returned (Ajzen & Fishbein 1980). 250 was considered the minimum number of questionnaires that should be sent out to achieve a statistically reliable test population. If automated mailing had been available a larger number would have been sent, although financial constraints also had to be considered.

#### **4.2.3 Data storage and manipulation**

All questionnaires returned from the three surveys have been archived for future use should they be required. Summaries of returns are given in Appendices 1 to 3. Each survey was analysed by assessing percentage

responses for each question and cross relating questions within subject headings.

Ranking of data responses has been used extensively to illustrate particular subject area responses.

#### **4.3 Analysis of questionnaire topic results**

Each topic within the questionnaire has been examined within this section as a separate item. The results of each individual analysis then ends with a conclusion and tested hypothesis for the test population of farmers.

The topics within the questionnaire are as follows:-

**Legislation and Enforcement**

**Finance and constructed works**

**Advise and Information sources**

**Attitudes and concerns**

**Level of knowledge**

**Financial**

Within each section it is apparent that a number of questions had been poorly constructed and consequently resulted in inadequate responses. These have been highlighted and modifications suggested (Appendices 1 to 3).

Responses have been further subdivided to test the hypotheses by grouping farm sizes and farm type together. Comparisons were then made between



these types.

Statistical testing was undertaken using the software package SPSS. A variety of tests was carried out to demonstrate the correlation or otherwise between groups of responses. These topics included farms of varying acreage, different farm types, and farmers who had undertaken schemes.

Statistics used included those in the groups Analysis of Variance and Parametric tests, to test various hypotheses that had been put forward (Norusis 1993).

#### **4.3.1 Farm ownership responses**

A small number of farms responded that the farm was no longer in use and some declined to fill in the survey because the farm was purely arable based. An unsubstantiated hypothesis might be that, those having knowledge of farm effluent matters and livestock returned completed forms. A typical comment on uncompleted form is "cannot help as no longer have any livestock". Uncompleted forms sent back were, 15 in May 1992 and 12 in November 1992.

The May 1992 questionnaire asked for the size of farm and an indication of farm type. The responses given by the farmers in East Anglia are shown in Appendix 2. These proportions are similar to MAFF published data (MAFF 1990-B) for East Anglia and reveal the predominance of cereal (arable)

farming in East Anglia. Farming types in East Anglia are frequently concentrated in specific area types often according to soil type (Oakes 1989). For example the large scale cereal farmers are concentrated in Central Suffolk called "High Suffolk", on heavy clays, and often they have an associated piggery enterprise that utilises the cereals produced. However irrigation of effluent on heavy land during the winter months is very difficult and an immediate conflict with water quality interests is apparent. Beef enterprises tend to be widely spread across the area since they are often housed in traditional farm buildings and not restricted by soil type. Pollution associated with beef holdings is not significant, provided subsequent manure storage is not near watercourses.

The number of poultry farmers responding was very low since most larger scale poultry units in East Anglia are no longer part of a farming enterprise but an isolated large scale operation, run by a national company, dedicated to chicken farming and marketing. Pollution from the rearing of chickens is not significant (Schofield & Bascombe 1989) compared with other sources, although the subsequent storage of manure can cause pollution, particularly with the associated high ammonia content. Subsequent processing of the birds in abattoirs is a high water user and often gives rise to a significant effluent load.

Size of farm holdings for all surveys showed the majority of farms to be of sizes 200 - 500 acres and 500 - 1500 acres. This represented over half of the

total, with the majority of the remainder being in the category 50 - 200 acres. Only one farm, somewhat surprisingly was greater than 1500 acres. MAFF (1990-B) data shows a typical East Anglian farm to have on average 430 acres. (The question unfortunately asked for too broad a band of acreage, it should have included 100-200 acres).

#### **4.3.2 Legislation**

A summary of conclusions in respect of legislation, from the questionnaire responses is as follows:-

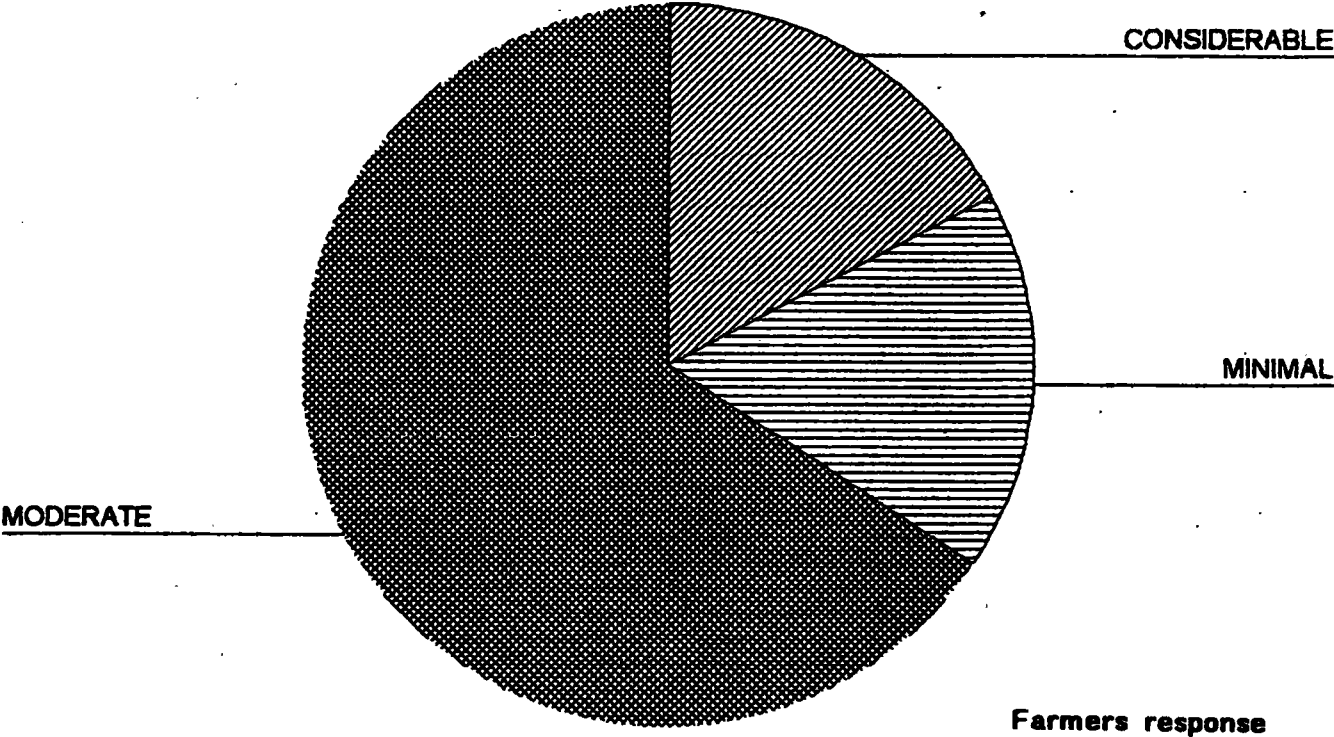
- (a) A small majority of farmers consider the law is too complex for their everyday interpretation. A minority do not consider the law is too complex, whilst most farmers sometimes have interpretation problems.
- (b) Most farmers believe that the rationale and background behind legislation is not adequately explained. None of the respondents stated that this aspect was good, with the majority stating it was only marginal (See Table 10).
- (c) A majority of farmers claim to have been affected by environmental legislation such as the Silage, slurry and Agricultural Fuel Oil Regulations.
- (d) Most farmers state they have some knowledge of the environmental

legislation affecting the agricultural community, relating to pollution control (see Fig 25). Statistical analysis (Chi-Square) reveals that the farmers in the group, dairy, pig and poultry have a significantly better knowledge than arable and beef farmers (level  $p < 0.05$ ).

- (e) Specific detailed knowledge of legislative requirements has been shown by questionnaire responses, to be inaccurate in the majority of cases.

**Figure 25.**

**KNOWLEDGE OF POLLUTION LAW**



Knowledge of legislation, as with other information is generally passed to farmers by agricultural literature, particularly agricultural journals (see

Appendix 2 & 3). By refining the question in respect of legislation sources, it was subsequently determined that 68% of farmers found that "important information on new legislation and regulations" was obtained from articles in their agricultural magazines. In the responses there were no negative replies at all, which indicated the importance of legislation articles from journals, although views of those not responding is unknown.

The complexity of the law was, surprisingly, not considered to be a great problem in everyday interpretation. It is suggested that the articles are written at a level easily enabling interpretation. Only 22% responded positively to the question "is the law relating to pollution control too complex for everyday interpretation by farmers". However 54% considered it to be too complex on a few occasions.

**Table 10**

**Farmers Opinions - Farm Legislation**

Topic	Responses			
Farmers knowledge of legislation	Comprehensive	Marginal	Poor	
	12	46	12	
Is law too complex for farmers?	Yes	Marginal	No	
	15	48	7	
Is legislation adequately explained?	Good	Adequate	Marginal	Poor
	19	35	15	

It is possible that farmers do not consider it necessary to have a detailed understanding of pollution legislation. The courses run at Otley and Silsoe Agricultural Colleges in farm management (Otley 1993) have a minimal content on environmental legislation and effluent control. It is grouped in college syllabus with sections on general farm safety legislations and is not emphasised as being of singular importance. From the farmer's viewpoint the risk of prosecution and the consequent fines can be derived from a variety of other activities on the farm, from financial matters to vehicle operations, and not always pollution orientated. The major difference that may not be appreciated within the farming industry, is that pollution generated by a livestock operation results from a core farm activity and is therefore, critical to the farm's economic viability. The cereal farmer has no waste product to dispose of, whereas planned disposal of manure and effluent is essential if the livestock enterprise is to remain operable. Talking this point through with farmers it is evident that dairy farmers have a perception of the importance in controlling effluent, while others, particularly pig farmers, often give it secondary importance. Some pig farmers known to me have entered the industry, not taking account of effluent disposal costs, or have insufficient land to dispose of slurry at the recommended application rates.

In discussions as part of the oral survey, examples were obtained of pig farmers who principally concentrate on the economics of the farming

enterprise. Subsequently when environmental expenditure has to be incurred the profitability of the farm is threatened in an unforeseen manner.

The survey shows that although farmers claim from the questionnaire responses to have a fundamental understanding of the law, they do not have a fundamental understanding of legislation before embarking on or expanding an enterprise. It is not unusual to meet pig farmers in Suffolk keeping 1000 fatteners on a holding of 10 acres, which is inadequate land area for safe effluent disposal. Government policy and its implementation may be to blame since information disseminated is inadequate on occasions. Fair to poor knowledge only of farm effluent regulations is demonstrated in the survey returns.

Other aspects however are the economic implications of legislation that are often only apparent after the legislation has been enacted on existing farming enterprises. As a consequence a government department may on occasions not enforce legislation vigorously, for political reasons, if it is subsequently realised that it will have severe economic implications for the industry, when it has been enacted. For example guidance notes on the Slurry and Fuel Oil Regulations now issued have allowed some discretion by field officers enforcing them.

#### **4.3.3 Finance and Constructed Works**

A summary of the data from questions relating to finance and constructed

works is as follows:

- a) Many farmers believe there is some possibility of spending on pollution control works making their farm uneconomic in the future.
- b) A majority of farmers are currently spending between 1 and 3% of their annual turnover on pollution control works (See Table 11).
- c) Construction of alleviation works is a recent phenomenon on East Anglian farms, with the majority of farmers undertaking schemes in the period 1989 and 1992.
- d) The majority of respondents consider that the current grant of 50% on fixed pollution control works is set at the correct level. However 32% gave a response that a 60% grant would be more acceptable than the current level.
- e) The farming community currently consider that livestock farmers are heavily penalised in having to construct pollution control works. The arable farmer has had none of these overheads in recent years.

38% of farmers surveyed have constructed a farm effluent scheme, 25% have not undertaken any work and 22% were not involved in livestock farming (see Table 12 & Fig 26). Those that did comment, that they had constructed works, also detailed timescales relating to the question 'Do you believe that environmental controls impinge on the profitability of your farming enterprise?'



Size of farm affects expenditure on pollution prevention works, since the cost of a lagoon is on average between £15,000 - £20,000 regardless of acreage.

The responses from smaller holdings show that they anticipate spending a higher proportion of annual turnover on pollution prevention schemes in future and that they are largely pig farmers (see Table 11). In this category are the

**Table 11**

(Nov 92 test)

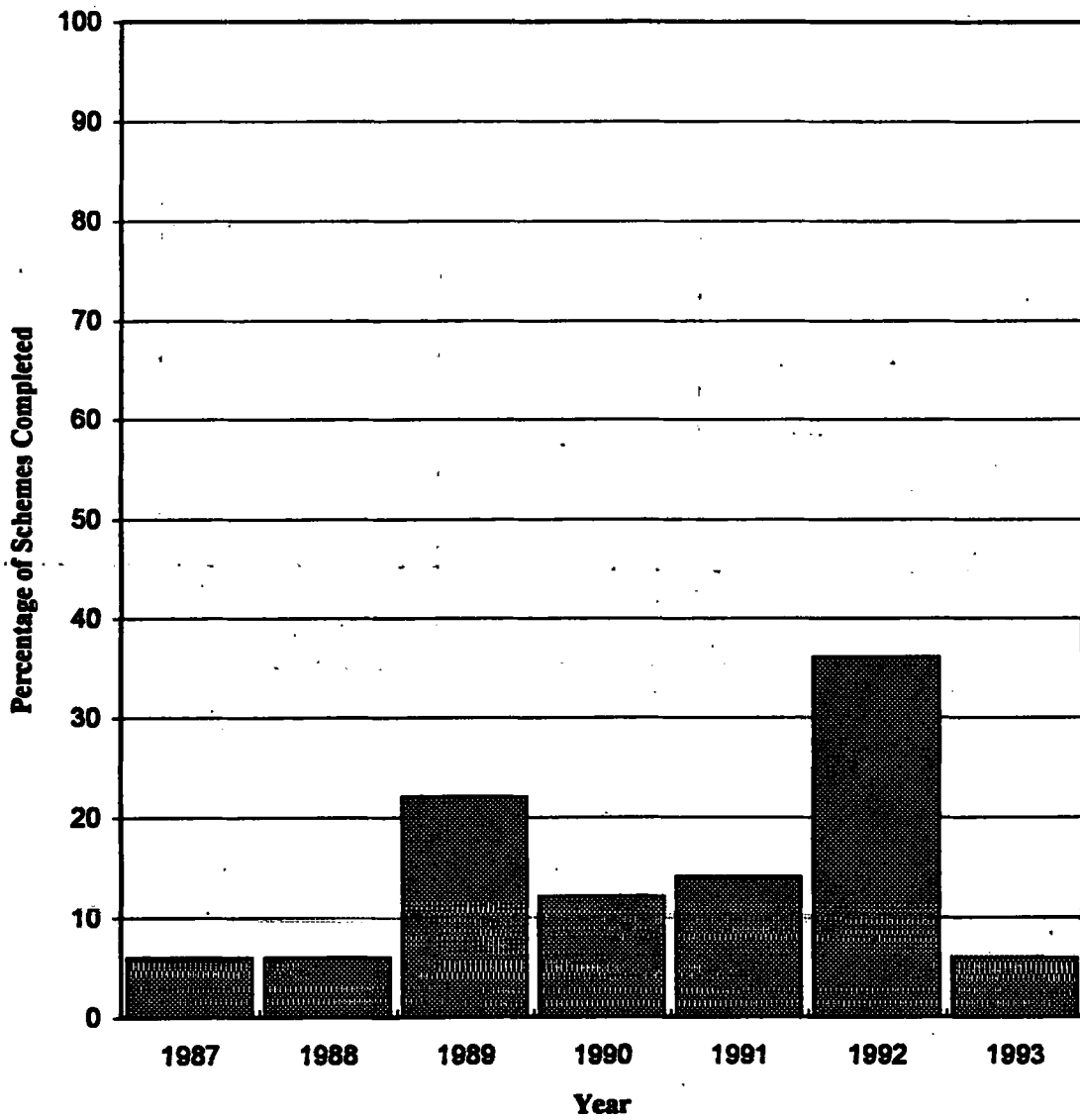
**Questionnaire Responses**

**Expenditure on farm pollution schemes as proportion of annual turnover**

Pollution expenditure	No's Farm Size in category (acres)					Total Numbers
	< 50	50-200	200-500	500-2000	2000+	
0%	5	13	4	9	0	31
1%	0	2	1	4	0	7
2%	1	1	3	3	1	9
3%	1	0	1	2	0	4
4%	1	0	0	0	0	1
5%	1	0	0	2	0	3
> 5%	0	0	0	0	0	0

**Figure 26**

**Pollution Alleviation Work Undertaken**



**Farmers response**

**Table 12**

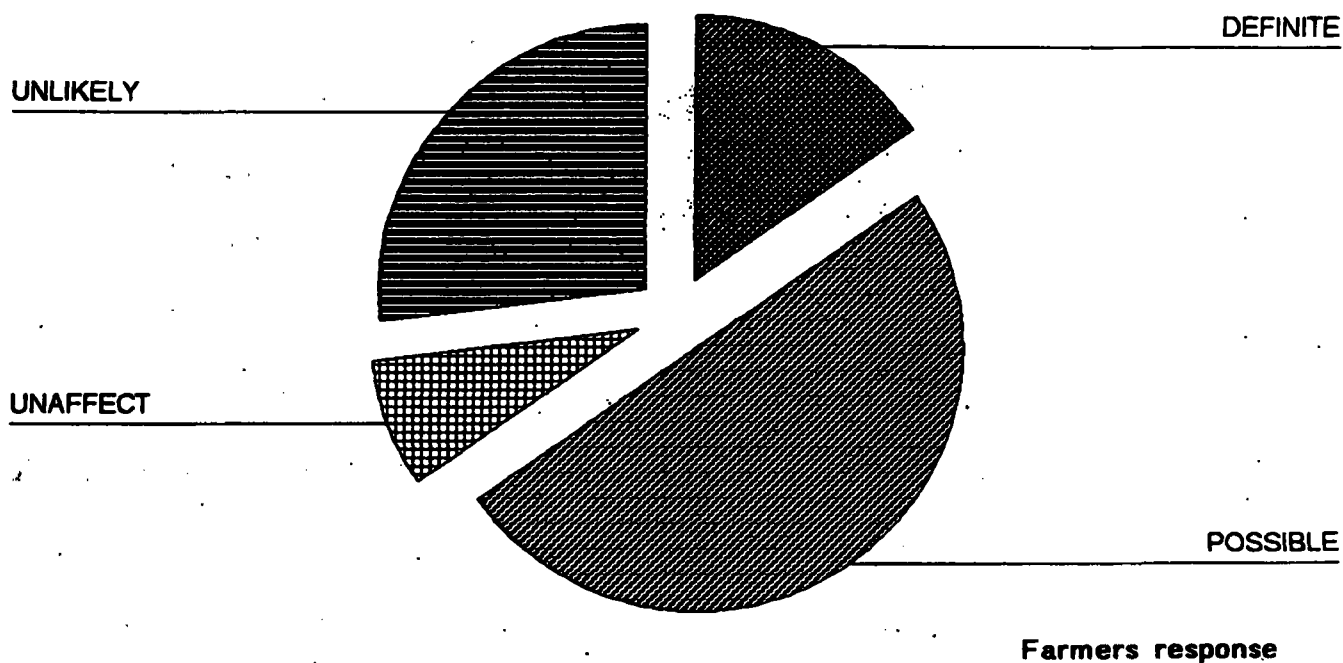
**Responses regarding effects of Silage and Slurry Regulations**

**(Note - Nov 92 test)**

<b>Farm Category</b>	<b>Affected</b>	<b>Not affected</b>	<b>Total</b>
<b>Dairy</b>	<b>1</b>	<b>1</b>	<b>2</b>
<b>Beef</b>	<b>0</b>	<b>3</b>	<b>3</b>
<b>Pigs</b>	<b>3</b>	<b>2</b>	<b>5</b>
<b>Poultry</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Arable</b>	<b>8</b>	<b>20</b>	<b>28</b>
<b>Mixed Farms</b>	<b>39</b>	<b>19</b>	<b>58</b>
<b>Category Totals</b>	<b>51</b>	<b>45</b>	

**Figure 27**

**Economic effect of new Slurry Regs.**



small acreage pig farms whose principle income is the piggery (MAFF 1990-B), as against larger farms, in excess of 250 acres, who have mixed enterprises and consequently a lower overall proportion of expenditure on pollution schemes. Figure 17 shows a reduction in income in recent years for pig farmers. Statistical analysis of data using Chi-square tests reveals results in Table 13 have no significant difference (Level  $p > 0.05$ ) between responses (Cross-tabulation Chi-Square test. Norusis 1993), although farms in the group (50 to 200 acres) undertook more schemes than statistically expected.

The farmers that did have livestock holdings, responded in 30% of cases that pollution control works could make their farming enterprise uneconomic in future. An additional 4% stated that any additional effluent control works would certainly make the farm no longer a viable economic unit. Of the responses, only 2% stated that they would definitely not be affected economically. These pessimistic attitudes are also typical of responses in the interviews. In reality a whole variety of factors interact to affect the economics of a farming enterprise (see Fig 17) and environmental expenditure can tip the balance on marginal farms.

One of the most important economic factors on any farm is the market price for livestock and dairy products (NFU 1984). Figure 17 shows the wide cyclical income fluctuations that have occurred over the previous decade. When market prices are low or subsidies are reduced/withdrawn, the additional economic burden of constructing effluent works may be

"catastrophic".

**Table 13**

**Association between farm sizes and farm schemes constructed**

<b>Farm Size (Acres)</b>	<b>Scheme Undertaken</b>		
	<b>Yes</b>	<b>No</b>	<b>Total</b>
<b>Less than 50</b>	5 (EV = 4.9)	2 (EV = 2.1)	7
<b>50 to 200</b>	8 (EV = 11.2)	8 (EV = 4.8)	16
<b>200 to 500</b>	8 (EV = 7.0)	2 (EV = 3.0)	10
<b>500 to 2000</b>	16 (EV = 14.7)	5 (EV = 6.3)	21
<b>Greater than 2000</b>	3 (EV = 2.1)	0 (EV = 0.9)	3
<b>Note - EV = Expected statistical value (SPSS)</b>			

This situation has been illustrated particularly by small pig farmers who often do not have the "buffer" of mixed enterprises on larger farms and are principally a single profit source farm. The large farms have a variety of income from setaside, "milk cheques", cereals and specialist crops. This problem was recognised by the government in 1989 when the 50% grant was initiated (NRA 1992). Dairy farms do not have the same scale of problem as a regular income from a milk cheque guarantees a regular monthly income and therefore the ability to finance environmental expenditure.

It should be noted that the existing grant of 50% is generous in relation to other agricultural and industrial grants and should not necessarily be considered as a permanent grant.

#### **4.3.4 Enforcement**

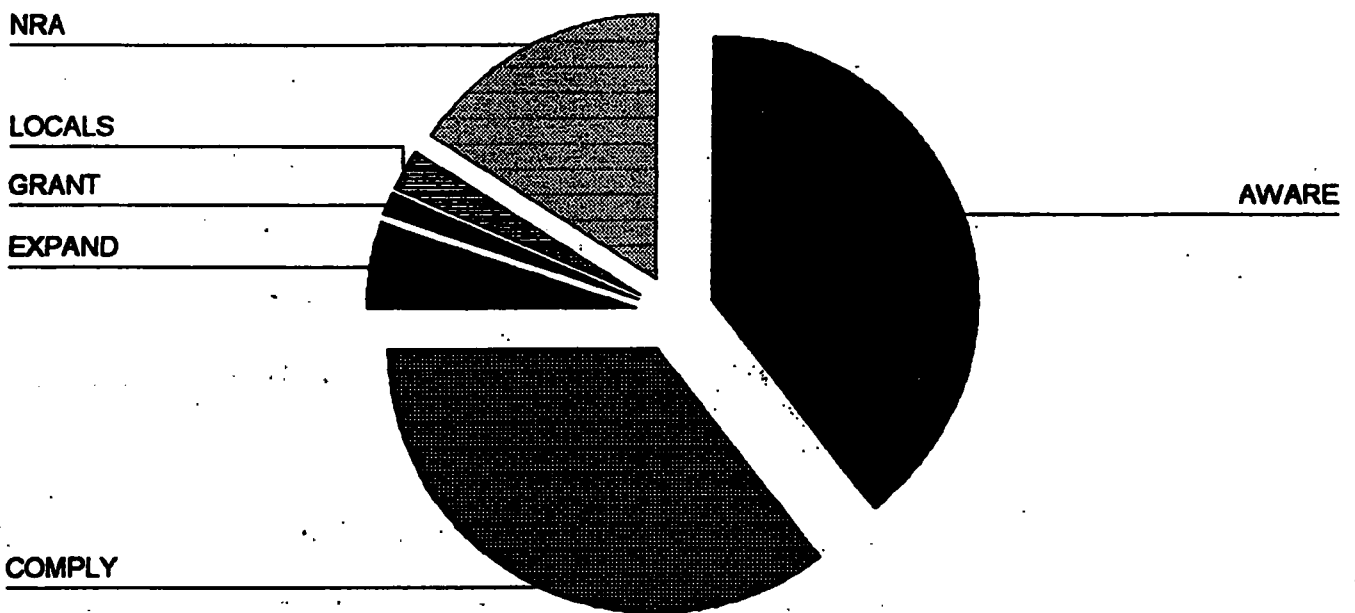
Enforcement of pollution legislation is without doubt an emotive subject in the agricultural community. Responses to the questionnaire appear to be on the conservative side, since conversations recorded between farmers tend to show a more forthright and more caustic attitude to enforcement of the law.

In the responses to the question, "what is their opinion of current policing of pollution control legislation by governmental type departments", 38% believed it was at the correct level, but 25% considered it to be impractical if farmers are to run their farm in a normal manner.

Of the farmers, when asked to state what principal factor caused them to initiate pollution control work, 76% gave a majority response that it was general awareness of the problem. Secondly 33% responded that it was a desire to comply with the law. A mere 17% stated that it was a NRA requirement as part of a enforcement policy imposed upon them. This illustrates the still modest enforcement policy of the NRA in imposing mandatory requirements. It may well be that many farmers would wish to instigate pollution alleviation works before being forced to, by the relevant authorities (See Fig 28). Another aspect is that some NRA areas do not have

**Figure 28**

**Cause of remedial work start**





a uniform enforcement policy with problem farmers, since finance is not available to construct the necessary works, ie Hill farmers, even if it is a statutory requirement. This had been particularly noticeable in poor farming areas of Wales, the North West and Yorkshire (Robertson 1977, Schofield & Bascombe 1990), where farming is only undertaken with the assistance of EU grants.

The possibility of a prosecution being brought against them concerned 93% of respondents although this was a poorly worded question because it is "closed". The feature of prosecution that most worried farmers was the fine, which has been increased to a maximum of £20,000 since 1989. Much publicity has surrounded this new level of fine although in practise the average fine imposed on farmers is around £4,000 (NRA 1992). 56% feared the possibility of the fine but, 44% were concerned about the associated publicity that a prosecution would bring. It would be interesting to establish if publicity within the farming community concerned them. In conversation farmers gave the impression that prosecution of a neighbour was a humorous and "hard luck" matter, not necessarily taken very seriously. Publicity from the wider community, particularly locally, may be regarded more seriously ie local opinion could turn against them (Carr & Tait 1989).

The important points in respect of enforcement are as follows:-

- (a) Farmers are initiating their own pollution control works before enforcement action is taken in the majority of cases.

- (b) Prosecution was a threat taken seriously by farmers due to of fear of the size of an associated fine.

#### **4.3.5 Advice and Assistance**

No clear pattern was evident as to the sources of advice used by farmers. Although MAFF (ADAS) was approached most frequently when seeking assistance with pollution control schemes, it was not always regular and other contractors were also approached. However a higher number of respondents stated that they always sought the advice and assistance of the NRA. As grant aid is dependent on approval by NRA and MAFF it is not surprising that their advice and assistance is obtained. However other bodies such as the NFU and Agricultural contractors are nearly as popular and are perceived to represent the farmers viewpoint and are therefore likely to help in minimising financial outlay. The group, that the questionnaire showed was rarely consulted was the farm consultant, and this may be because it is a recent phenomenon. In practice the farm consultant may be a necessity in future, in order that a particular scheme complies with all aspects of the regulations (See Appendix 4). The actual number of times consultation was made by either MAFF or NRA during the last five years was tested. Farmers were three times more likely to have had a visit by MAFF than NRA during that period. The question is now overtaken by recent policy changes since the NRA visits have increased considerably in the last three years. Nevertheless the conclusion from this data is that MAFF/ADAS is much more active in field work than NRA and is largely working in an advisory role compared to NRA's

enforcement and advisory role. From this data it is apparent that field work and site visits by NRA and MAFF often duplicate efforts and consequently the question should be broached, should joint site visits be a future development (Taylor 1991).

It is apparent from subsequent questioning that specific advice and assistance is only obtained from the more formal organisations ie MAFF/NRA (See Table 14 & Table 16). Farmers that belong to a variety of environmental organisations such as FWAG and CLA state that they very rarely seek their assistance on pollution control matters.

Factors that initiated contact with either MAFF or NRA were related to pollution issues in 38% of cases, although a further 22% related to concerns about compliance with new UK or EU legislation. One of the patterns evident from the farmers is that pollution issues will often be raised with MAFF since NRA may consider legal action against polluting farms. However when asked if policing of pollution legislations was at the correct level, the majority gave a positive response.

**Table 14**

**Farmers sources of environmental advice**

Organisation	No of visits/assistance
MAFF	50
NRA	16
Environmental Organisations	9

A summary of important points in respect of advice and assistance is as follows:-

- (a) MAFF and ADAS are the organisation most frequently used for advice on pollution control matters.
- (b) Environmental organisations and groups are not regularly approached by farmers for advice.
- (c) Contact with MAFF and NRA was frequently in respect of a proposed effluent scheme but on occasions asking their advice re. new legislative requirements.

**4.3.6 Information Sources**

Information sources are in many ways one of the most important aspects of establishing how farmers attitudes and actions are influenced (Carr & Tait 1989). It is apparent that the information gathered by a farmer is the influence that he subsequently uses to form an opinion on a particular subject. The accuracy and bias of information is of great importance if a true

conception on a particular environmental point is to be formed.

The hypothesis proposed and examined is:- Farmers attitudes and actions with respect to farm effluent control and remedial pollution prevention work are derived from advice obtained from government departments as a primary information source.

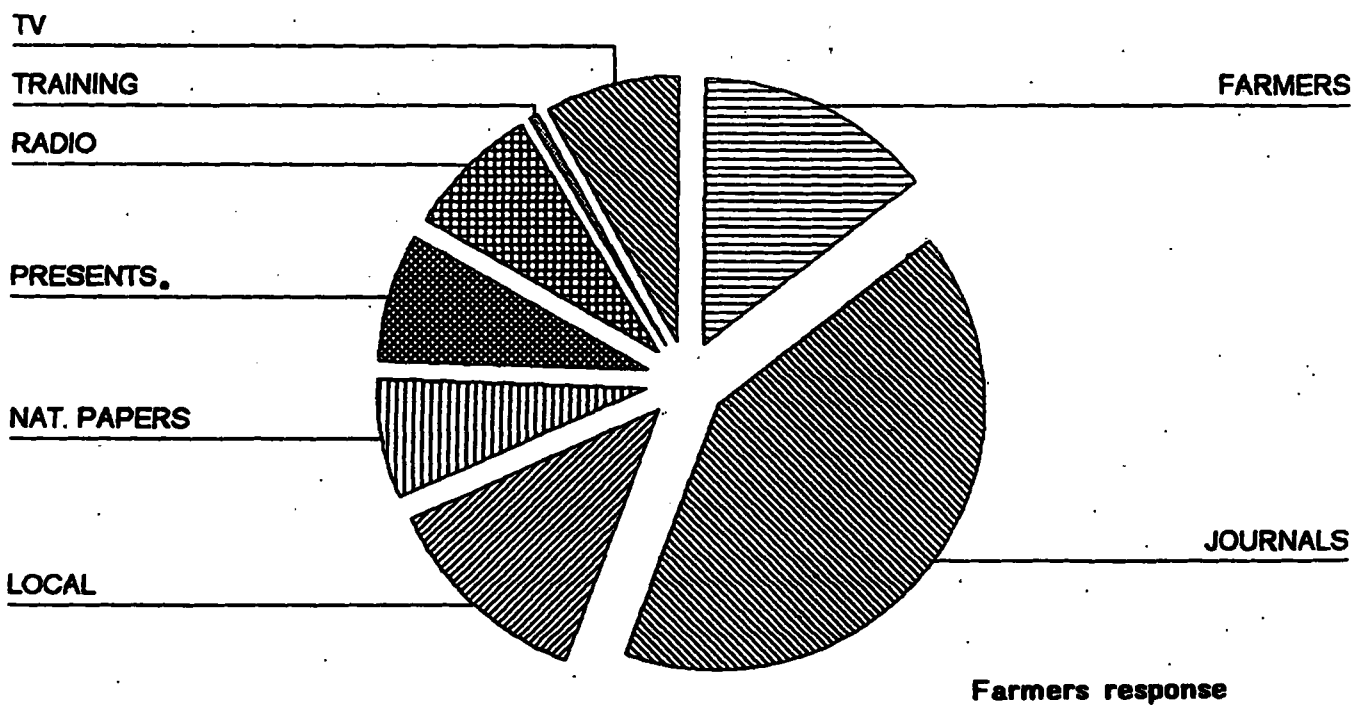
This hypothesis was postulated since a significant proportion of information made directly available to farmers is from statutory organisations such as MAFF, ADAS and NRA. These organisations regularly disseminate technical advice and explanations of legislative changes (NRA 1992) and they believe that it is a primary important information source for many farmers (CLA 1984). This is reinforced by the fact that a main route of information to the farmers is governed by statutory instruments such as Grant Aid, Subsidies and Legislative Requirements.

As well as this primary information route it was supposed that other organisations such as NFU and the Press also feed information to farmers, gained from the governmental sources.

When asked, 92% of farmers responded that agricultural journals were the most important source from which source they had learnt most about environmental issues affecting the farming community. Other sources not as important were other farmers at 29% and local newspapers at 23%.

**Figure 29**

**Sources of farm enviromental information**



Surprisingly media such as television, radio and national newspapers only had a 14% response rate (See Fig 29).

Since agricultural publications are the most significant information source for farmers it was then established which publications were most frequently read and for how many hours a week. The Farmers Weekly is by far the most popular magazine/journal with Farming News being only half as popular. Many other publications are read by small numbers of farmers and may have a greater influence than is first apparent since often they target a particular group of farmers such as those involved with pigs.

The amount of time spent reading agricultural magazines and journals varies considerably with one respondent spending eight hours a week reading them! However 39% of the farmers spend between one and two hours a week reading them. Considering the size of most of these journals (typical 50 pages) then only selected articles can be read in any depth within a one to two hour slot (see Table 15).

Statistical analysis (Cross tabulation Chi-square test. Norusis 1993) shows that farmers that read journals between 1 and 2 hours a week are more likely to have correct knowledge of statutory pollution control requirements, although there is no significant difference (level  $p > 0.05$ ) between any of the groups. Statistical testing was carried out comparing correct knowledge against hours spent reading and farm size, to establish potential links. For all

of these the p value was  $>0.05$ .

When asked to list their formal sources of information in respect of farm effluent pollution control matters ADAS/MAFF publications were the most popular, but the agricultural press was the second most important source for them. Others such as NFU, FWAG and consultants did not rank more than 5% of the total.

A number of points are apparent from these responses. Farmers state that magazines such as Farmers Weekly are largely purchased for stock and grain market price trends. Publishers however have a wide range of articles in such magazines, and environmental features appear to be widely read, as an important source of information. The information gained from such journals is apparently more widely respected than that from government sources because it is written with a bias towards the farmer, or at least of neutral slant. The cost of Farmers Weekly at £1.75 per week is not an inconsiderable sum per annum, but is considered worthwhile by many farmers, since a primary information source for many topics, is in the one journal.

Although the routes of information postulated originally are probably correct, the critical point is that information from governmental institutions although widely disseminated, is not highly regarded, or used as primary information source by the farmers.

A summary of the important points that have been drawn out from questions relating to information sources is as follows:-

- (a) Agricultural journals are the most important and popular information



source for farmers.

- (b) The Farmers Weekly is the most widely read publication, for between 1 and 2 hours a week.
- (c) ADAS and MAFF literature is widely read when obtaining information on requirements for farm effluent control schemes.

#### **4.3.7 Attitudes and Concerns**

The majority of farmers belong to a wide cross section of environmental organisations that have loose links with farming activities. The most popular and directly linked with farming is the Farming Wildlife Advisory Group (FWAG), with 12% of members among respondents. It is doubtful if many farmers belong to this organisation for environmental and pollution control motives, but largely for interest in natural history and game topics. FWAG has a wider perspective, with considerable emphasis on wildlife management, as seen from reading their literature, which also has a secondary financial benefit for farming shooting syndicates. The attraction of grants for countryside improvement projects also makes FWAG (Stewardship Scheme) an attractive organisation for the farmers having medium sized to large farms (McArthur 1993). The second most popular organisation, the County Landowners Association, is primarily a body to represent the interests of landowners, as a balance against adverse government policies, environmental organisations, and the Ramblers Association (CLA 1984) - see Figure 30.

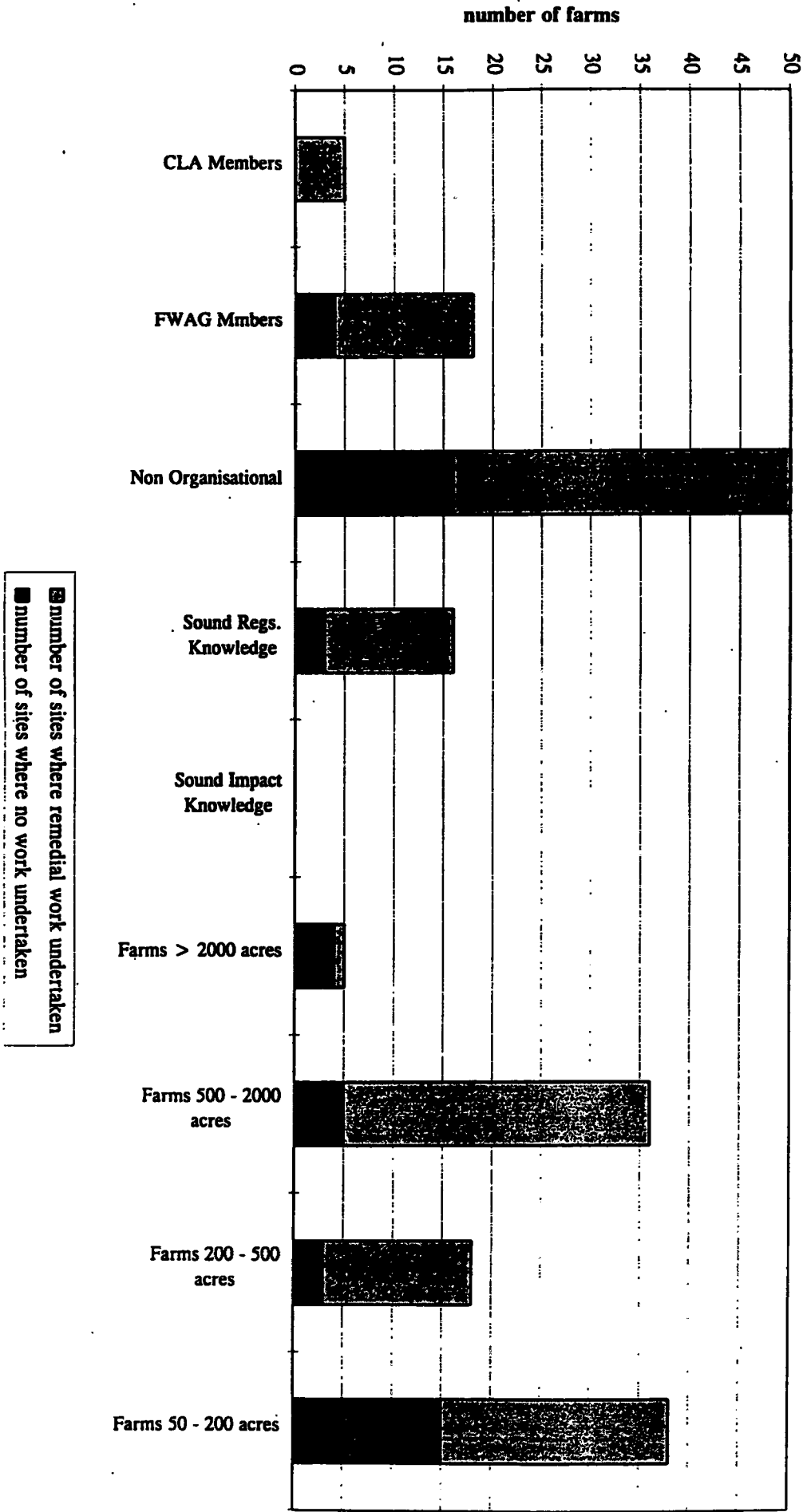
When asked if they considered themselves to be active environmentalists, 68%

responded positively and only 9% gave a negative reply. Although the question was not perfectly worded, it nevertheless illustrates that a majority of farmers consider themselves to be environmentalists. Perhaps the same type of response would be given if one asked the public in general "Do you consider yourself to be a responsible citizen". However when the farmers were asked in what respect were they environmentalists, they gave very few examples of their actions (see Table 14 & Table 16). Examples given included tree planting, managing permanent pasture, and taking extra care in farming activities. They were asked in a subsequent question to detail actual works carried out over the last 2 to 5 years, and the category responses are illustrated in Figure 26. The actions they have taken relate to activities that will be eligible for grants and result in some economic improvement.

When asked what the principal factor was that caused them to initiate pollution control works, the majority either responded that it was a general awareness of the problem or that they had a desire to comply with the law. 18% of respondents stated it was an NRA requirement that had to be complied with, whilst the remaining majority gave factors such as Local Complaints, and Farm Expansion and Modernisation. This illustrates a more positive environmental attitude than was apparent from the previous responses. It shows the majority of farmers have an understanding of the legislation requirements and a desire to comply with the law. The fact that most are prepared to initiate work rather than opt for "brinkmanship" with the NRA is a positive environmental attitude.

When developing environmental attitudes the majority state these are developed from articles in journals such as Farmers Weekly. Somewhat surprisingly, these attitudes are only developed from contact with neighbouring farmers in one third of cases. Interview results suggest that it is not as clear cut as the questionnaire analysis leads one to believe. Farmers have multiple contacts with external information sources, and the journals such as Farmers Weekly, are more likely to reinforce on existing information for the farmer and to then develop an existing environmental attitude. This attitude or perspective will be formulated after discussion and debate with other farmers and external influences that they come in contact with. Analysis of data in Table 15 using the Cross Tabulation Chi-Squared test, Norusis (1993) reveals that there is no significantly better level of environmental knowledge in farmers, who read more agricultural journals (level  $p > 0.05$ ).

Figure 30 Association Between Farm Type and Alleviation Work Undertaken



**Table 15****Association between knowledge of Regulations and time reading agricultural journals****(Nov 92 test)**

<b>Farm Size (acres)</b>	<b>Hours spent reading</b>					
	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>Less than 50</b>	<b>0</b> 1	<b>1</b> 3	<b>0</b> 1	<b>0</b> 1	<b>0</b> 0	<b>0</b> 1
<b>50 to 200</b>	<b>1</b> 4	<b>1</b> 5	<b>2</b> 12	<b>0</b> 3	<b>0</b> 0	<b>0</b> 1
<b>200 to 500</b>	<b>0</b> 3	<b>1</b> 2	<b>1</b> 3	<b>0</b> 1	<b>0</b> 0	<b>0</b> 0
<b>500 to 2000</b>	<b>0</b> 5	<b>0</b> 6	<b>1</b> 5	<b>1</b> 1	<b>0</b> 2	<b>0</b> 2
<b>Above 2000</b>	<b>1</b> 2	<b>0</b> 0	<b>0</b> 1	<b>0</b> 0	<b>0</b> 0	<b>0</b> 0
<b>Totals</b>	<b>2</b> 15	<b>3</b> 16	<b>4</b> 22	<b>1</b> 6	<b>0</b> 2	<b>0</b> 4

**Note - Top right corner of square indicates correct regulations knowledge (No.)**

**Table 16**

**Association between Environmental Status and Farm Scheme constructed**

(Nov 92 test)

<b>Farm size (acres)</b>	<b>No enviro interest</b>	<b>FWAG</b>	<b>Wildlife Trust</b>	<b>Other Enviro organisations</b>
<b>Less than 50</b>	5 7	0	0	0
<b>50 to 200</b>	12 19	1 2	0	4 6
<b>200 to 500</b>	5 6	0 1	0	2 2
<b>500 to 2000</b>	2 10	6 7	0 1	3 4
<b>Above 2000</b>	2 3	0	0	0
<b>Totals</b>	26 45	7 10	0 1	9 12

**Note - Top right corner of square indicates scheme constructed (No.)**

**A summary of the important points that have been drawn out from questions relating to attitudes and concerns is as follows:-**

- (a) More than half of farmers state that they are "environmentalists".**
- (b) Most farmers take remedial action to control farm effluent pollution at their own instigation.**

- (c) Attitudes by farmers are developed primarily from agricultural journals but subsequently modified by external influences.

#### **4.3.8 Levels of Knowledge**

After sending out the two initial surveys it was apparent that levels of topic knowledge varied considerably between respondents. In the third survey it was therefore decided to simply test by various questions, the depth of understanding in respect of environmental legislation and pollution.

As we are dealing with farm pollutants and their deleterious effects, a question was asked as to which pollutant was the most damaging to a river from a list of five pollutants. Table 9 shows my acceptable order and the results obtained from farmers. Many respondents gave a combination of partially correct but no answer was totally correct. This illustrates the lack of detailed knowledge about pollutants by most farmers, although approx 50% gave a combination that was plausible. It would be likely that information about these farm pollutants has been publicised by the appropriate bodies ie NFU, MAFF and NRA. In practise, many factors affect the potential impact of a pollutant. Volume of the discharge, initial dilution and biodegradability of the pollutant all can affect the potential to kill fish and deoxygenate. However, in general effluents such as silage liquor can be classified as those that are highly polluting and this is understood by the farmers.

A further check questions was "what is the minimum storage required for

farm effluent/slurry under the Silage, Slurry and Fuel Oil Regulations. 18% of respondents did not know, 14% got the correct answer in 4 months storage and the remainder gave answers varying from three months to twelve months (See Fig 31).

From these responses there is some evidence to suggest a link between those farmers who had knowledge of regulations, and those who have already installed a farm effluent scheme (from questionnaire responses), although the correlation can not be justified by Chi-Square statistical analysis (Level  $p > 0.05$ ). However the lack of detailed knowledge about a topic that has been well publicised in the agricultural press, is indicative of poor understanding of detail. It is likely that farmers have read articles about the requirement but not absorbed all the details. Requirements will in any event have been stipulated to them by MAFF/ADAS when a scheme was being prepared. It is unlikely that a farmer will prepare and construct a effluent scheme without seeking the 50% grant aid, and consequently design criteria would be checked by MAFF/ADAS, without the farmer needing to be involved in the detailed design.

To check if farmers understood why new regulations and controls have been introduced, the question was posed "Do you believe that levels of pollution in rivers in your vicinity have altered in the last ten years". The responses showed an equal split between 30% considering that no change had occurred and 30% believing an improvement had taken place. 14% responded that they



believed rivers had deteriorated in their vicinity. When compared with NRA annual surveys of the freshwater rivers, the statistics are comparable, although, no accurate comparison can be made because of the question format differences.

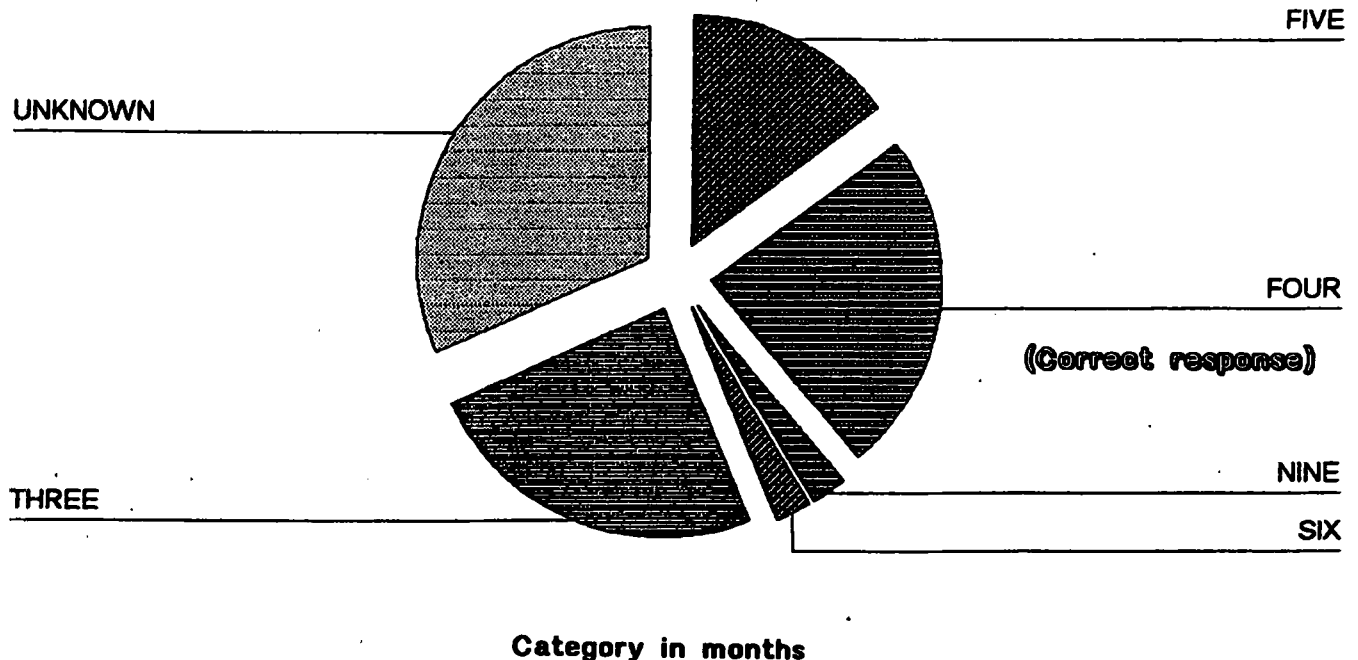
When asked if the new farm effluent legislation could result in improvements in river water quality, 48% considered it was definitely or potentially that this would be the case. This response is encouraging although much education on this topic remains to be done.

The salient points from questions on levels of knowledge are:-

- (a) Understanding of detail in respect of pollution control legislation is poor, although Dairy, Pig or Poultry Farmers have a statistically better knowledge than other farmers.
- (b) The impact of pollutants on rivers is not well understood by farmers, although the effect of silage liquor is generally accepted.
- (c) Benefits to the nations rivers from the controls imposed on farmers are not perceived by them in general.

**Figure 31**

**Number of farmers responses to question re.  
statutory lagoon size**



#### **4.4.1 Specific comments by farmers**

Included in this section are a cross section of comments quoted from questionnaire responses. They have been included to illustrate farmers strength of feelings on environmental topics from their own narrative. Appendix 5 gives specific examples to illustrate the views of farmers.

A considerable bias is however evident since all responses (only 15% of total) are critical and obviously reflect farmers with strong opinions. The majority with moderate views have not given any additional notes and narrative.

#### **4.4.2 Conclusions from farmers comments**

##### **Economic**

A number of issues are apparent that are common to the respondents. The economic decline of some farms is blamed on the need to meet pollution control requirements. Farms are quoted that have had to cease farming because of the considerable costs arising from pollution prevention work. A number of points arise from this type of example - Are poor returns on the farming enterprise incorrectly blamed for exorbitant pollution prevention overheads. For example replacement of a tractor will be budgeted for in most cases, but traditionally no money has been set aside for pollution prevention work. The case is that frequently expenditure is unexpectedly required to control pollution, that has suddenly been brought to their attention by the enforcement agencies. What has altered in recent years is that the construction of a compromise scheme is no longer allowed (NRA 1992) and design and construction must be in accordance with the regulations. The consequent costs are therefore greater now to meet new standards. An argument put forward by the regulators is that if pollution is occurring at a farm, the farmer is making profits at the expense of the environment. For example, if a farm disposes of effluent illegally into a watercourse and avoids constructing a £20,000 effluent lagoon he will make profit at the environments expense. What a farmer perceives as acceptable pollution is of course often not tolerated by the authorities and is considered to be illegal. The contaminated surface water from farmyard holding areas is often considered to be unpolluting by many farmers, yet NRA will have the opposite view.

The 50% grant on pollution works is inadequate in the eyes of many farmers responding and is not sufficient to keep a farm viable when carrying out a scheme. The quote often given is that expenditure on pollution prevention is not money making, but that argument could equally apply to other areas on the farm, such as taxes, building maintenance and footpath upkeep.

### Legislation

Many of the comments related to the justifiability of the recent legislation in improving the environment. Comments include remarks such as "legislation must be proved to be necessary". Also a belief that legislation is "influenced by persons, or bodies, with vested interests", concerned farmers.

Their comments are given from the farmers perspective and many people would argue that it is not the farming communities prerogative to propose or block legislation. The current pattern is that environmental organisations and subsequently government, put forward legislation to address areas of concern which can be debated by the farming interests, before being translated into parliamentary bills. It is of course for parliament to ensure that legislation is balanced for all interested parties. In the United Kingdom however the farmers have a well developed lobby and many would argue that their viewpoint is fully taken into account.

The important question that is often not answered is, does strict environmental legislation subsequently improve water quality? if the end effect is unclear

then the farmers criticisms may be justifiable!

### Environmental

The comments on environmental issues all tend to suggest that the environmental lobby has too much influence. They question the need for limits on nitrogen application and do not understand that it is a pollutant. It would appear that they are not aware of the effects of eutrophication in rivers. The same comments come back as those concerning pollution prevention regulations, that nitrogen limits proposed are unpracticable to work and potentially will make many farms uneconomic. Examples are also given where ADAS has historically encouraged increased yields and production by the use of nitrogen compounds, yet the advice and legislation is now contrary to that previously given. (See Appendix 5). However farmers are also very adept at being vociferous on all occasions when new legislation is being proposed. This is apparent from the articles and correspondence in farming journals which increase in volume when new proposals are formed for discussion eg 1991 Slurry Regulations and Nitrate Vulnerable Zones.

Although many of the farmers responding considered themselves to be environmentalists it would appear this in practise relates to nature conservation matters. They do not understand, as would be expected, the complex detail of river pollution chemistry and consequent needs for controls.

#### **4.5 Cross checks and associations**

Over the course of the three surveys cross check questions were built into the surveys in respect of topics, information, attitudes, economics, legislation and the environment.

Individual surveys have been analysed and are quoted below as examples:

##### **Farmer A example survey responses**

Considers himself to be an environmentalist but does not belong to an environmental organisation. His opinions on environmental matters are principally developed from his family and FWAG. His environmental knowledge is not detailed in that he cannot correctly list the strength pollutants in terms of effects on rivers.

Information on new legislation is often obtained from agricultural journals and is typically read for 1½ hours a week. However it is likely that this is only general knowledge since he would not answer the question asking for the minimum storage under the new Slurry Regulations.

He has a large farm 500 - 2000 acres which had a dairy herd. This has recently been sold because he considers that new legislation requirements made it uneconomic for him to continue in milk. He has a desire to comply with the law and had taken ADAS advice but none from the NRA. The exact details of why he considered it necessary to abandon the dairy herd because

of pollution prevention costs is not apparent. The questions that should subsequently be asked (if the reports had not been made anonymously) include, was sufficient advice given before that decision was made and was final contact with NRA initiated to discuss the problems. Has the surface water and groundwater in that locality subsequently improved now the dairy has closed! If no change was detected then, is legislation, Silage, Slurry and Agricultural Fuel Oil Regulations appropriate in cases such as this, and does it result in improvements in river water quality that could not have otherwise been obtained by traditional techniques.

#### Farmer B example survey responses

Does not belong to any environmental organisation and is not an active environmentalist.

However he has undertaken pollution control work at his own instigation on a farm of size 500 - 2000 acres. Information on new legislation and environmental matters is normally obtained from agricultural journals, government sources and agricultural colleges. He anticipates that in future mandatory pollution control work will make the livestock enterprise on his farm uneconomic, yet currently he does not spend any of his farms annual turnover on pollution control works nor does he anticipate this position will alter within the next five years. This illustrates an anomaly in that he considers his livestock may become uneconomic yet no monies are planned to be spent on environmental improvements. The legislation currently in force

is anticipated as being a long term measure and consequently inadequate financial planning for such requirements seems imprudent although perhaps inevitable because of low profit margins.

#### Farmer C example survey responses

He has small farm of less than 50 acres and does not consider himself to be an active environmentalist yet he has a higher level of knowledge and responsibility than the two previous examples given. He often obtains legislative information from agricultural journals such as the Anglian Farmers, but for views on environmental matters it is the opinions of his family that he totally respects. Advice, help and assistance had not been obtained from any environmental organisation. His knowledge of incoming legislation from the EC, initiated consultation with NRA and MAFF/ADAS. When undertaking pollution control work he also states that the principal reason was a desire to comply with the law. Currently he spends 4% of his annual turnover on pollution control works and anticipates this will rise to 5% in approximately 5 years time. His understanding of issues involved in river pollution is detailed and correct, although like the majority of farmers he cannot give the correct minimum storage required for lagoons. The impression given from his responses is that he is a prudent farmer with expenditure under control. He thinks it is unlikely that pollution control works will make his farm uneconomic in future. Other farmers who consider the future to be uneconomic in their responses to me are also those who do not have any detailed knowledge of legislative requirements or costings! It is likely, from



my deductions, that those farmers who have specific understanding of future requirements and costings, do not consider the future for them to be uneconomic, because of their attention to detail.

#### Farmer D example survey responses

This survey is typical of a medium sized farm of between 200 - 500 acres. Again he does not claim to be an active environmentalist or seek assistance and advice from such organisations. The responses given are not contradictory and cross check questions show similar attitudes as to the majority of questionnaire returns. It is noticeable that this farmer is not as "correct" in his responses as the previous example given. For example he often obtains information on new legislation and regulations from agricultural journals yet he has been criticised by the River Authority for polluting a watercourse with effluent. The previous farmer anticipated spending 5% on pollution prevention works in future whereas this farmer is only to spend 1% and indicates that his farm will become uneconomic in future. Again the environmental opinions respected include family, neighbours, colleges and the Agricultural Press. It is noticeable that the expertise of NRA in this area is not acknowledged by respondents, presumably because they principally see the NRA as a enforcement agency. His knowledge of the new construction requirements was good as was his understanding of effects of pollutants. It is apparent from his responses and comments that he is of the opinion that the regulations will not bring about river water quality improvements and are therefore draconian and financially constrictive.

#### **4.6 General Conclusions**

It is apparent that from the results of the surveys that many farmers perceive that they are behaving in a correct environmentally responsible manner. The return rate of the questionnaires indicates a considerable interest in the subject and some of the respondents requested a copy of this thesis. Whether they are planning financially for the future in respect of controlling polluting discharges is questionable, since the majority do not plan to increase sums available and consider livestock enterprises may soon become unviable.

##### **4.6.1 Comparison of the three written surveys**

Comparison of the three surveys is limited since consequent versions were a refinement and improvement on the previous one. The third survey is therefore gaining a better unbiased response to questions.

A number of common aspects are apparent from responses to all three surveys. The majority have been affected by the Slurry and Agricultural Fuel Oil Regulations since their introduction in 1991. They also consider that profitability has been affected by environmental controls at the present time and increasingly so in the future.

Legal questions were developed in subsequent questionnaires and for example in the first questionnaire 75% stated that the possibility of legal action concerned them, but when given other options they subsequently revealed that a general awareness of the problem instigated remedial work for most of them, not the threat of legal action, although still a significant factor.

Another common theme running through all surveys was the point that legislative and environmental issues were most effectively presented by agricultural magazines. This is the majorities's principle information source, although opinions were developed from a wider range of materials including, Family, Agricultural Colleges, Neighbours and Magazines.

The relationship of MAFF/ADAS and NRA is unclear from the responses given in all three surveys. A number of negative aspects perceived include:-

The majority do not use such organisations for environmental and legislative information when needed.

Advice and assistance given by MAFF/ADAS was considered to be more beneficial, than that obtained from NRA, although many complex factors affect this relationship with the farmers ie Grant Aid, Enforcement Status, Primary Information Source.

#### **4.6.2 Comparison with oral survey conclusions**

Direct comparison cannot be made but a number of common topics are apparent. The oral survey by its nature shows development and expansion of a topic which then clarifies anomalies arising from the written surveys.

The written survey revealed concerns in respect of costs of implementing pollution control work. Conversations with farmers show that typically they

believe that implementation of legislation is not consistent in that works required varies according to the attitudes of individuals field officers. Examples given include disparity between the need to provide expensive linings for lagoons in areas of loam soils. Others include the lowering of the requirements for 2 days retention in pump sumps if the officer considers sufficient safeguards exist. Although some flexibility is appropriate for field officers this should only follow considerable training that currently does not exist in any significant measure. Typically water quality officers will have had only 2 days training since the 1991 regulations were introduced.

Another aspect from oral surveys not apparent in the written version was the question of design criteria to take account of abnormal conditions. Many farmers fear a NRA prosecution associated with a wet weather discharge but cannot design a system to cope with weather extremes. The argument is also put forward in respect of optimum periods for nitrogen applications in that narrow windows of acceptable application timescales cannot be adhered to on heavy soils in wet periods.

The affects of pollutants is an area not clearly understood in detail by the majority of farmers. This relates not to details of river chemistry, but simply which farm organic compounds do the most harm to rivers.

As a general comment however it is apparent from oral interviews that farmers have a detailed knowledge of many environmental issues that is not

apparent from written questionnaire responses. Written survey answers obviously limit the reply and do not allow expansion and development of a particular topic.

#### **4.7 Conclusions from survey data**

- (A) It is apparent from findings that information sources are very important to farmers in providing an update on a variety of topics such as new legislation, grant changes, new farming techniques, policy changes, etc. The most significant information source for farmers is the agricultural journals (normally the Farmers Weekly) and forms the basis of opinion formation along with subsequent discussion with neighbours and family. A qualification is of course that some government notes are a primary source of information although they are usually elaborated and explained in the agricultural press subsequently.

The original hypothesis proposed must therefore be modified to read as follows:-

Farmers attitudes and actions with respect to farm effluent control and remedial pollution prevention works are derived from advice obtained from agricultural journals as a primary information source.

- (B) The knowledge of the farming community in respect of improving river water quality associated with improved farm effluent control, is limited.
- (C) It appears that inconsistencies in implementation of regulations concerning

farm effluent schemes are taking place. The National Audit Commission are currently undertaking a full audit of farm pollution control.

- (D) The future viability of livestock farms is questionable according to farmers responding in these surveys. They cite increasing expenditure on environmental control as the prime reason.
- (E) Responses from farmers have also identified a need for training in the subtleties of approaches to farmers, to avoid current criticisms. Training of NRA and MAFF staff in implementation of farm waste regulations is minimal and inadequate at present. With a national organisation such as NRA training across the UK should be organised, if the present anomalies identified by NRA staff and farmers are to be resolved.

## **CHAPTER 5**

### **5.1 Press attitudes and agriculture - Introduction**

This section examines the way that the agricultural press influences the farming community, firstly by examining the type of journals that are available, which are the most popular (see Appendices 1 to 3), what is their principle use, and what are the sources of articles. Secondly a selection of typical articles taken from journals over a two year period have been examined in detail to look for bias, inaccuracy and common themes.

It was apparent from questionnaires that the agricultural journals are a most important information source within the farming community. It is important therefore to determine the way magazines influence farmers. Within governmental circles (NRA 1992) the use of journals as a primary information source is not widely appreciated. Government literature from organisations such as MAFF and NRA is widely available on many topics, yet the farmers state that this is not used as frequently, as a journal article based on that information. The hypothesis examined in this section is that:- Governmental information is only widely used by farmers when it has been presented in a popular and practical way within an agricultural journal that the farmer trusts.

#### **5.1.1 Agricultural Journals - Background and usage**

The following journals are given in descending order of popularity in responses to the questionnaires.

**Farmers Weekly**  
**Farming News**  
**British Farmer (NFU)**  
**Pig Farming**  
**Pig Weekly**  
**Arable Farmer**  
**Whats new in Farming**  
**Anglia Farmer and Contractor**  
**Farming Business**  
**Dairy Farmer**

Editors and journalists on the above journals were contacted to establish the basis behind producing an article. A standard set of questions were asked, (see Table 17) but discussion often developed from these questions. A number of common themes emerge from approaches to the press:- They all welcome discussions and questions, appearing to have open attitudes to environmental attitudes.

Comments made by the press are precised as follows:-

Articles for a particular date are put together to be topical and appropriate for the readership of a journal. When a topic has been chosen, in depth knowledge will frequently be gained by the journalists telephoning around known contacts within the industry. These contacts are often contractors and suppliers of agricultural equipment, but equally experts within



**Table 17**

**Oral questions put to agricultural editors**

1.	When putting together a article, what is the usual information source used.
2.	If external authors are used for articles, what checks are made of content re accuracy and bias.
3.	What experience and qualifications do you expect your staff to have.
4.	What determines when a article should be published. Has it got to be published only when it is topical. Do you have external requests to print articles from say MAFF etc.
5.	Do you mostly try and present articles from the farmers viewpoint (and complexity).
6.	Do you find from your feedback, that farmers act on the advice given in pollution prevention articles written by you.
7.	Are there any particular lobby groups that have an influence on your articles ie NFU etc.

the specialist agricultural universities and contacts within NFU, MAFF, ADAS and NRA are also used. Although articles are often put together at the journals instigation, inputs are frequently received from a variety of independent and government sources. If an article is based on external information and materials, then checks are made to establish the extent of bias and potential errors. Articles are also received direct from MAFF and ADAS, but subsequently transposed into a format acceptable to the farmer. Many of the journalists emphasise that they are not writing articles from a neutral viewpoint but one that reflects the farmers views and needs. An article that will present new MAFF environmental requirements will often have comments about their viability, practicality and implementation eg Nitrate Vulnerable Zones. If the journal disagrees with these requirements then it

will not hesitate to present that view. The likely effect of such an article will be that farmers are going to assimilate the opinions presented and use them to formulate their own views. However the extent of criticism of governmental issues is dampened by the realisation that "strong criticism" will potentially result in information sources drying up.

Many editors and journalists had considerable experience and professionalism. The majority had some practical farming background and frequently possessed an agricultural degree or qualification.

Although journals are the most widely used information source, newspapers are equally important for farming news as it occurs. Local papers in East Anglia have experienced local agricultural editors who have large sections on topical matters one day a week. On other days smaller articles will appear of interest as well as market prices in the area. Agricultural sections in papers such as the East Anglian Daily Times are small, with an editor who has personal connections with many influential farmers in the vicinity. These articles in local newspapers are aimed at the farming community and people connected with it, since this represents a significant proportion of the readership. By contrast agricultural articles in the national press contain less technical content, but have universal appeal. The difference between articles in journals and those in the local newspaper are that the former are more technical and comprehensive. Certainly in the questionnaire responses farmers claim to be influenced by journals to a much greater degree than the daily

papers. A trend in local papers has been to place considerable emphasis on wildlife and conservation matters, in particularly the works of FWAG and Wildlife Trusts. A common misconception in the minds of some farmers and the public relates to environmental improvements resulting therefrom.

#### **5.1.2 Articles - Pollution and the Environment**

It is apparent from examination of many farming press articles that practicality, with copious illustrations, is the format that farmers find suitable, when learning about new regulations and controls.

The Farmers Weekly (FW) has occasionally produced fifteen page pull-out supplements on specialist topics that can be retained as reference documents. FW produced a pollution control supplement in November 1991 as a preliminary to the control of pollution regulations. The supplement produced a variety of articles that were balanced and certainly not overtly orientated to the farmers perspective. A summary of its contents is as follows -

Introduction - "Rise to the challenge" illustrated with an effluent lagoon about to overflow titled "A pollution time bomb" (Taylor 1991). The first article is "NRA plays vital role" written by an NRA officer outlining the new legislation requirements and a new policy of prosecution by NRA (Bateman 1991). The end of the article has two very pertinent sentences "The regulations will be applied sensibly and consistently across the country and will supplement existing legislation." In retrospect this was an optimistic statement, in reality inadequate training and management of staff involved, has

resulted in inconsistencies that farmers not infrequently raise with the authorities (Audit Commission 1994). The NRA article contained a large amount of detail regarding acceptable legal practices, the general impression is that of an article being a little short on precise practical advice aimed at the farmer, although very technically and legally correct.

The next article contained more practical advice and balanced the NRA one. It was entitled "Know your risk rate" by J Mogg of Genus Pollution Group. The author details useful disposal methods and makes some important statements. For example "The ability of a field to accept applications of farm waste depends on many factors, some obvious and some less so". Through the article he gives details of likely effluent generation, storage capacities and associated costs for a variety of livestock holdings. The article ends with the comment "Following this step by step approach and concentrating on the important factors will enable most farmers to comply with the present and probable future legislation (Mogg 1991).

Subsequent articles include - "Overcoming Odours" by N McDiarmid and then "Dutch to get tough" by J Burns. The Dutch article is presumably meant to give comfort to British farmers since the Dutch have considerably tighter legislation! (Burns 1991).

The final article in this supplement relates to the use of aerobic digesters to upgrade pollution control systems. The treatment systems described are

innovative and still to be proven on a large scale. A danger therefore exists in providing detail in this article that it may look attractive as an alternative to conventional systems. The problems with maintaining consistency of effluent quality to enable continuous discharge onto land or into a watercourse are not mentioned. A theme running through the second part of the article is criticism of NRA in terms of expensive requirements and indecisiveness from officers advising on a scheme. Other inaccuracies in this article were noted, such as the statement that an oxygen meter in a effluent lagoon measures the BOD (Levin 1991).

A useful feature of the supplement was the considerable number of pollution control adverts detailing varied types of equipment of the market.

Supplements as detailed above are not a common occurrence in Farmers Weekly, although effluent related articles are normally put in at least once a month.

A more recent shorter article (22.1.93 FW) is an illustration of a government department (ADAS) promoting its services as it becomes an independent financial unit. The article has many excellent photographs showing examples of good and bad practices. It promotes the first visit by ADAS as being free, and states "details certainly aren't passed on to organisations like the National Rivers Authority" (Cousins 1993). To the farmer this may appear odd that government departments are working in the same area, but divorced! The

point is entirely missed that to obtain grant aid approval, it is necessary for NRA to go on site to approve the scheme.

Another (2.4.93 FW) was based on a joint project between Newton Rigg Agricultural College and the NRA to eliminate stream pollution from an existing dairy and beef unit. The slant of the article was towards advice and practical solutions. Noticeable areas not covered include a mention of MAFF or ADAS and no explanation of grant aid availability despite detailed construction costings being given (Hunt 1993). This article coming so close on that produced by ADAS (22.1.93 FW) must lead the reader to wonder to which organisation to turn to, for the correct advice and consents.

Another specialist article (29.1.93 FW) was not offering advice but a warning of runoff problems associated with very wet weather that had been a problem in January. The article was an interview with a NRA pollution control manager (Davies 1993). The tone throughout is alarmist and is probably designed to prompt action, with mention of the £20,000 fine and the fact that many farmers resisted spending money and are opting to manage their inadequate systems as efficiently as possible. The central theme of the article was that adequate storage is required to cope with exceptional periods of rainfall. The entire article was not written with the frequent sympathy for farmer's problems, and perhaps gave a stark warning of not meeting the requirements of the 1991 regulations.

Articles that discuss topical issues in FW are occasionally found relating to pollution and one pertinent piece sums up what many farmers have recounted. It states "at the very least it (government) should extend grant aid to installations that divert clean water away from slurry lagoons, which might be enough to make many stores comply with legislation". (17.4.92 FW Editorial).

### **5.1.3 Pollution Control Articles**

Articles detailing the measures and equipment available abound in magazines such as FW. It is likely that this reflects the commercial interests of manufacturers and certainly journalists state they are a significant information source for many articles.

Typical of the articles regularly appearing detailing usage are the following:-

"Slow slurry injection is the manufacturers response to NRA's policy, slow dilution and dispersion pays" (Roberts 1993). It then details in technical language the specification. At £9000 purchase price it is not a realistic purchase for most farmers (30.4.93 FW). Other articles in the machinery section include " A Cheshire farming family believes its methods of cleaning dirty water is a low cost option, which has been overlooked by most experts". (15.5.93 FW) The article has provoked considerable interest but does not highlight potential problems such as unsuitability on heavy soils and areas of high rainfall (Davies 1993). A much more practical article entitled "Keep rainwater out to control dairy pollution" was written after an interview with

a consultant (Taylor 1993). Much useful advice was given regarding diverting surface water and design criteria (12.3.93 FW). A subsequent article by a ADAS consultant (2.4.93 FW) entitled "Don't store up trouble" gives useful tips on the types of slurry stores currently available (Falkingham 1993). Another article (Anthony 1992) detailed the use of low rate irrigators and their effectiveness (27.3.92 FW).

It is recognised that most solutions to farm effluent problems are detailed in agricultural journals and that these provide an excellent starting point for choosing an option suiting a specific farms requirements. Fig 32 shows there are consistently more mechanisation and pollution equipment articles than those relating to legislation and the environment. However when the readership of such magazines is looking for practical and readable advice, articles are consequently tailored for that need and will not include over emphasis on pessimistic matters eg potential NRA prosecution etc. Fig 32 shows the wide range of articles published that includes non environmental topics.

#### **5.1.4 Conclusions**

- (a) Important information and advice is frequently given to farmers in journal articles. It is doubtful if such accurate advice is obtained from another impartial source in such popular public presentations.
- (b) Governmental organisations tend to present their own viewpoint on occasions which can be unintentionally to the detriment of the government departments

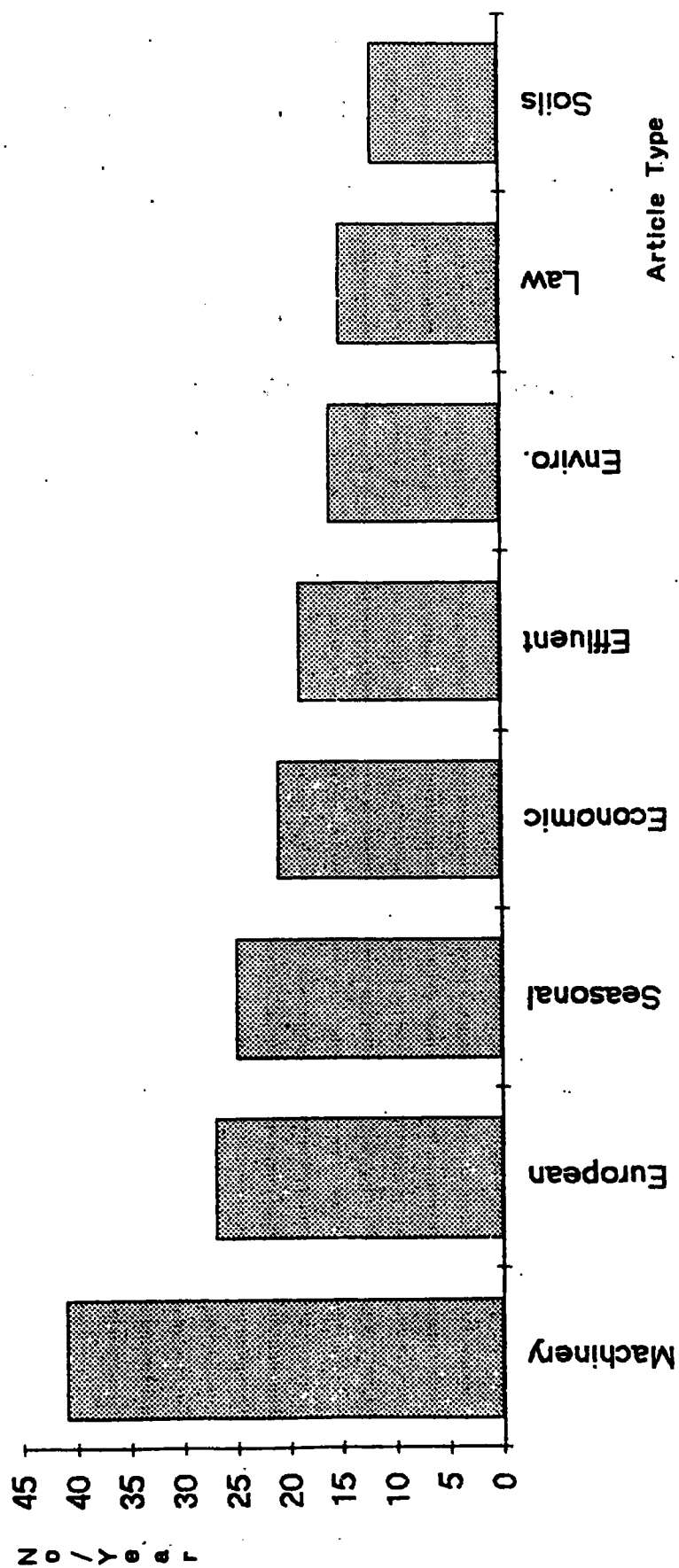


and cause confusion for farmers.

- (c) The presentation and accuracy of articles appears to be of a high standard although interpretation of policy issues can be varied.
- (d) The authors of such articles have been found to have agricultural experience in the majority of cases and certainly have extensive contacts within the industry for researching articles and verifying governmental statements.
- (e) Environmental articles are in the minority within the makeup of a particular journal.

Figure 32

Distribution of articles / Year -Farmers Weekly (1993)



## **CHAPTER 6**

### **6.1 Introduction**

The help and co-operation of the farming community throughout the study was surprisingly good, considering it was a subject not central to their farming activities. No antagonism or resistance to being interviewed or answering a questionnaire was found.

Attitudes of MAFF and ADAS are more typically governmental, with information release being extremely difficult on occasions for alleged reasons of commercial confidence to the farmers. NRA information release is more open although specific cases of pollution are rarely disclosed to the public because of legislative constraints. The annual bulletin by NRA/ADAS on water pollution from farm waste, however, is an excellent document for detail of trends in pollution statistics associated with farm effluents. Views expressed are biased to the governmental viewpoint and lack perspective from the farmer or NFU ie a balanced argument from both sides. Other documents such as the NRA's "The influence of agriculture on the quality of natural waters in England and Wales" have drawn together for the first time technical detail relating to this major problem (NRA 1992). Such documents are however not widely available to the farmers and normally remain within governmental circles.

No direct relationship could be established between pollution statistics and river water quality in East Anglia since the pollution parameters are invariably

influenced by multiple factors. Studies for small catchments sometimes show this relationship clearly ie Welsh studies in rural areas, but in larger catchments multi factors,, in addition to farm effluent, all have an impact of river water quality.

## **6.2 Pollution information and statistics**

Although the statistics available from the farming community in respect of pollution events are widely available and provide a pessimistic history of problems, the record is better than other sectors of British Industry (NRA 1992). It is the context of agricultural pollution being apparent to increasing public access of the countryside, that the public perception of the problem is perhaps being exaggerated. For example widespread use of farm footpaths that cross farm streams frequently leads to complaints being passed to NRA.

Factors such as legislation, grant aid, weather and market price may all be associated with farm pollution incidents in a synergistic manner. The conclusion is that weather is certainly one of the most significant factors and is likely to be increasingly so in the future, as mandatory storage of effluent becomes widespread. The trend towards increasing size in UK for livestock holdings results in large amounts of slurry and effluent being held on large farms for subsequent irrigation. Although four months lagoon capacity is now mandatory for effluent storage, wet periods can extend for up to nine months, resulting in runoff from effluent irrigation on to land already at field capacity as lagoons become full in the winter and have to be irrigated. The ability of

authorities to control and improve farms effluent generation in wet weather is restricted although the availability of grant aid for clean surface water separation schemes would be a worthwhile innovation. It could be argued that in periods of very wet weather when river flows are high, the deleterious affects of farm effluent discharges into watercourses are limited. Vigorous enforcement of legislation during very wet periods is not appropriate, and is an unofficial policy adopted by some sections of the NRA.

It is established that some factors are important contributory influences on pollution statistics. Grant aid is one where the availability of the 50% in 1990 led to many outstanding farm effluent problems being resolved and this can partially be seen in the trends following its introduction (see Figs 6 & 15). Wet weather periods still override other factors as the principal influence. Other influences such as market prices have a longer term influence on the statistics since the ability of the farmer to finance environmental improvements depends on long term financial viability, through a stable market price for stock. It has been shown that intensive areas of particular farming types are stable over several decades, despite market fluctuations. For example the very large number of sizeable pig farms in Suffolk, a trend apparent since the second world war, has not declined dramatically since the pig price has fallen in the 1990's (see Fig 17). Long term investment in buildings and equipment often forces the farmer to remain with that sector of farming waiting for a price upturn, excepting a catastrophe such as bankruptcy. The indirect influence from market price rises is that capital is then potentially available

for environmental improvements, if the necessary persuasion (often legal) is given.

Without doubt the interpretation and analysis of trends from farm pollution statistics is a useful tool for all parties involved in agricultural control of effluents. At the present time insufficient use is made of the available information and only a limited number of parameters are considered on an annual basis.

### **6.3 Farmers Attitudes Survey**

The development of a survey format is a more complex task than at first envisaged. Although they were refined through three versions and numerous discussions with interested parties the final survey questionnaire could have been improved in retrospect. Questions should have been structured to enable better quantitative analysis to be undertaken. However the return rate was within normal expectations and it is presumed therefore that the farmers found that it was basically an acceptable format and did not provoke a hostile attitude.

A limited amount of attitude information was obtained from written questionnaires. Oral interviews with the farmers revealed more information (that had to be memorised) and gave a much less structured and informal perspective. Logistically it would be inappropriate to carry out all the surveys in an oral manner so a mixture of the two techniques is a realistic

compromise.

The answers given were not as anticipated at the outset and gave a surprising insight into farmers attitudes and knowledge in respect of environmental matters.

Without exception all expressed a desire to comply with the law, but in reality, practical and economic considerations are of prime overriding importance to them. The majority had pessimistic attitudes about future economic viability if all pollution prevention controls were adhered to. However, Governmental attitudes from 1992 onwards have been that industry and agriculture should not suffer unnecessarily from stringent environmental controls.

An important point relates to the influence of the agricultural press in influencing farming attitudes and imparting new information to them. It is clear that the press are the most important information source for the farmers. However other points were evident from the surveys conclusions that give a general picture of farmers environmental attitudes. Farmers have a very basic knowledge of farm pollutants and the deleterious effects resulting from their entry into watercourses. Their knowledge of the statutory requirements under the farm effluent construction regulations is barely adequate and understanding of particular fine detail is limited. The general impression however is that the modern farmer is attempting to keep fully informed of environmental

legislation and requirements in a responsible manner by reading agricultural journals and government literature.

#### **6.4 The farmers interrelationship with the Press**

Examination of the process of formulation of press articles revealed a comprehensive number of sources that are used to produce articles. Accuracy appears to be adequately checked and the journalists or authors qualifications/experience generally result in a well balanced article.

Articles in journals are produced in a topical manner to coincide with seasonal or legislative problems. Typical magazines such as Farmers Weekly have short articles in most issues and extensive articles regarding environmental matters on a occasional basis. Editors were aware that farmers used their journals as an information source but the degree of dependency for gaining new knowledge was not appreciated.

A number of articles from governmental departments gave advice that, although not inaccurate, did not fit well with the remit of other governmental organisations. From the farmers viewpoint if all detail in these articles was assimilated then confusion and contradiction in attitudes and areas of advice would be apparent.

Other media sources play a minor role in providing information although all such sources are frequently purchased for the primary reason of ascertaining



market prices and trends.

## **6.5 Organisational and Management implications**

### **6.5.1 Implications of finding and study review**

The original terms of reference were to examine farmers attitudes and actions and then correlate these findings with changes in river water quality that have been recorded in East Anglia. The investigation changed as the research progressed and much useful information was gained from the use of questionnaires and interviews with farmers and regulatory authorities. Although the link with river water quality cannot be documented as a quantifiable effect, it is without doubt that agriculture is a major influence on many of the British rivers.

The study revealed much information that required statistical analysis and greater emphasis should have been placed on this aspect when designing the questionnaires. However, the findings have shown areas that enable positive recommendations for managerial and procedural change to be put forward, arising from the study.

A number of general conclusions from the research are as follows:- (specific items and recommendations for change are detailed in subsequent sections).

The information channels to the farming community from governmental

departments are only partially effective. Inter-organisational approaches to farming are minimal and ineffective. The management systems put in place to control and advise the farming community are outdated and should be more emphatic in reflecting current practises and needs.

There is a move to change approaches to farmers in the last few years. With a positive "pollution prevention" philosophy being adopted. For organisations involved there is a need to put in place a structured management and training approach that will result in an effective and fair *modus operandi* for all parties involved, in controlling a significant environmental problem.

The implications of these findings for many organisations involved is for resource and management systems to be changed to incorporate the recommendations. It should however be noted that an holistic approach is needed in place of the multiple government departments that currently confuse the farming community. If governments continue to develop the proposals, to be adopted in the new Environmental Agency, of environmental controls coming within one organisation, then the natural development in marketing the new Agency is for all agricultural matters to be incorporated into it.

#### **6.5.2 Improved communication channels**

The study has shown that many livestock farmers have limited knowledge of pollutant effects despite the considerable volume of literature and material that

is supplied to farmers at a variety of public events. It has been shown that the information most commonly used is that put into the form of practical advice such as that found in Farmers Weekly. It could be argued that, it is not important that farmers need environmental information, as their principle interests centre around the food production systems. This argument is correct if historic practises are followed, but in recent years tighter control on effluent disposal, has necessitated all livestock farmers having knowledge of statutory and practical requirements.

The information given in the past by governmental departments has been presented in official jargon in a lengthy manner. The advice and detail given in future should be in the context of simple practical detail in a precis form. The more astute farmers or farm manager can then subsequently request detailed technical requirements from NRA and MAFF. It has been established that farmers spend only between 1 to 2 hours a week reading agricultural printed material, so there are competing subjects for the farmers limited reading time.

Implementation of these measures should be a simple procedure, although the use of "friendly" farmers to devise advise leaflets with NRA and MAFF is an innovation that should be considered. Links with agricultural journal staff are also an important area currently only adopted in a spasmodic manner. Regular articles should be submitted to popular journals such as Farmers Weekly, as a very effective communication channel. Consideration should

also be given to gaining permanent access to such journals, by sponsorship of a small number of pages. Commercial companies, such as spray companies already adopt this practise. Articles that NRA could present would reflect their interests other than regulatory ie fisheries, conservation and land drainage, as well as important seasonal advice and regulatory implementation notes. A business case can be put together that NRA's current costs of approximately £10,000 per annum on internal printing costs (agricultural material) could be reallocated so that more effective information is disseminated by the provision of £5,000/year in sponsoring an A4 side in Farmers Weekly.

Other communication channels that are known to be effective that can be developed, include one to one personal discussions with farmers. The acceptance of NRA and MAFF staff into agricultural colleges is another undeveloped area that has considerable potential.

### **6.5.3 Holistic approach for all government departments**

A considerable problem prevails in respect of conflicting and overlapping advice from governmental departments and organisations. The study previously detailed, gives examples of this problem that, is exacerbated by moves to rename and privatise traditional agricultural and environmental departments. An example of this is the redefined role of ADAS, that is now largely an commercial organisation with all the associated business pressures.

It might be argued that advice from many sources will then enable the farmer to take a consensus view. Although this is partly correct, the contradictory advice then given, causes confusion and misunderstanding. Although it is unusual for identical topics to be covered by different organisations, it is conflicting advice that must be received in a more effective manner. For example the enforcement of nitrogen applications by MAFF in Nitrogen Vulnerable zones (NVZ's) is contrary to some NRA advice regarding effluent disposal. Increased numbers of pollution incidents could result from strict enforcement, as farmers attempt to store additional effluent to meet the statutory applications "windows" required in NVZ's.

A solution to these problems can only be achieved at high governmental level with all potential areas of interest being passed to an environmental panel, consisting of officers from all organisations involved, including limited representation of farmers interests. This is of course another layer of bureaucracy and should be obsolete with the eventual aim of passing all agricultural environmental and conservation matters to one lead organisation.

#### **6.5.4 Total catchment studies and pollution prevention principles**

These studies have shown that many livestock farmers have little contact with NRA and will often initiate remedial work at their own instigation. The problem with sparse coverage of farms by MAFF and NRA, is that an unfair and uneconomic penalty exists for those farmers that are made to comply with

legislative requirements. Advice given is at present free and often it is helpful to the farmer, without them incurring excessive capital expenditure to implement it by adapting better working practises. If farmers proceed with effluent disposal arrangements to their own designs and criteria, problems often develop subsequently that result in further expenditure being necessary.

The systems to overcome the above problems have been put in place, although not fully implemented, because of diverse NRA and MAFF regional management styles (NRA 1992).

To implement total catchment studies and pollution prevention principles, they must be more proactive with information regarding these topics, emphasising the non-regulatory nature of this work. Regional NRA should adopt a 5 year programme of implementing catchment studies in all our river basins within that period.

The adoption of free farm waste management plans by ADAS is also a positive step that is now becoming integrated with NRA catchment studies in some regions. A holistic approach by all parties is a necessity, and positive planning management and marketing should result in improved river quality from this comprehensive approach to the problem.

## **6.6 Conclusions and recommendations**

Controls on farm effluent disposal in UK are now wider ranging and vigorously enforced. They are some of the most stringent in Europe. It is apparent from the research that the majority of farmers expect to conform to this legislation within the near future. The anticipated improvement in water quality cannot yet be demonstrated, if it can ever be measured. What is evident however is that wet weather plays a major part in the occurrence of farm pollution events on occasions. However such events are of minimal consequence compared with farm effluent discharges into low flow rivers in the summer months. The new regulations may considerably reduce the incidence of such problems.

An area that authorities such as NRA must address in future by wider publicity, is the improvements arising from tighter control of farm effluents. At the present time many farmers cannot see any significant advantages to the environment from their own economic commitment to meet the new regulations.

Governmental Departments should recognise the importance of agricultural journals in providing farmers with new information. The quality of their direct information appears to have minimal impact and lacks presentation. Contradictions between government departments must be rapidly resolved if respect for such advice is to be maintained.

Bodies such as NRA and MAFF should ensure that farmers realise the scale of environmental benefits that should arise from the enactment of

environmental legislation.

In view of the considerable expenditure involved for the farmers, a consistent approach by the authorities must occur in respect of implementing all agricultural regulations. This approach should be audited in a vigorous manner.

An assessment of the overall economic viability of livestock farms controlling effluent should be made, and consideration then be given to the adequacy of existing grant aid levels, in view of widespread concerns in the agricultural community with regard to current levels of environmental expenditure on farms.

Further research work needs to be undertaken by governmental organisations into the medium term effects of new legislation. Is the economic disadvantage arising therefrom proportionally balanced by the environmental gain, or is an unexpected imbalance becoming apparent!? In the county of Suffolk alone during a typical year, total expenditure on farm effluent schemes is in excess of 0.5 million pounds!!

Technical detail is correct in most agricultural articles studied and is often taken directly from the relevant legislation. It is the interpretation and implementation of these requirements that is given a different slant according to the authors background.



**In conclusion it would appear that effluent generation from livestock farming is always likely to be problematic, and that no amount of additional information and legislation will completely control a system subject to such a multitude of variable factors.**

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**ATTITUDES TO GOVERNMENTAL ENVIRONMENTAL CONTROLS****Questions**

Do you consider environmental legislation to be too restrictive for the agricultural community?

Yes            11                                  No            12

Is the law relating to pollution control too complex and anomalous for everyday interpretation?

Yes            9    No            10

Do you believe that the rationale and background behind new legislation is adequately explained?

Yes            7    No            11

Is helpful and practical advice given to you with respect to environmental matters from the following organisations?

	Yes	No
MAFF	15	2
NRA	5	10
NFU	12	4
Consultants	9	2
Contractors	6	6

Has the introduction of the Silage, Slurry and Agricultural Fuel Oil Regulations affected you in any way?

Yes            8                          No            6                          Unknown    5

Do you consider that the policing of environmental legislation is:-

Ineffective	7	Overmanned	3
Unnecessary	1	Correct level	6

**Has press coverage become biased against the agricultural community in recent times with respect to environmental matters?**

<b>Yes</b>	<b>20</b>	<b>No</b>	<b>0</b>
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**Would you consider yourself to be an active environmentalist**

<b>Yes</b>	<b>10</b>	<b>No</b>	<b>10</b>
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**Do you belong to any such organisations?**

<b>Yes</b>	<b>5</b>	<b>No</b>	<b>14</b>
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**Does the possibility of legal action against you for an environmental offence concern you?**

<b>Yes</b>	<b>15</b>	<b>No</b>	<b>5</b>
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**What do you consider presents environmental issues to the farming community most effectively?**

<b>Newspapers</b>	<b>1</b>
-------------------	----------

<b>Agricultural Journals</b>	<b>18</b>
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<b>Television</b>	<b>3</b>
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<b>Radio</b>	<b>4</b>
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<b>Public Presentations</b>	<b>3</b>
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**Do you believe that environmental controls impinge on the profitability of your farming enterprise?**

<b>Considerably</b>	<b>7</b>
---------------------	----------

<b>Moderately</b>	<b>8</b>
-------------------	----------

<b>Marginally</b>	<b>5</b>
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<b>Not at all</b>	<b>0</b>
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**Is the present grant aid level of 50% for pollution control works?**

**Too high .                      0**

**Correct level                      11**

**Too low                      5.**

**Any additional comments would be welcomed.**

**Thanking you for your assistance in this matter.**



May 1992

1 May 1992

ATTITUDES AND EFFECTS OF ENVIRONMENTAL CONTROLSQuestions

How much do you know about environmental legislation affecting the agricultural community which relates to pollution control?

A lot  Some  A little  Nothing

Is the law relating to pollution control too complex for every day interpretation by farmers?

Yes  Sometimes  No

Do you believe that the rationale background behind recent legislation such as the Environmental Protection Act is adequately explained at the time of implementation?

Good  Adequate  Marginal  Poor

From what organisations do you seek advice and assistance with respect to pollution control schemes.

	Always	Sometimes	Occasionally	Never
MAFF	<input type="text" value="9"/>	<input type="text" value="24"/>	<input type="text" value="16"/>	<input type="text" value="8"/>
NRA	<input type="text" value="17"/>	<input type="text" value="15"/>	<input type="text" value="12"/>	<input type="text" value="9"/>
NFU	<input type="text" value="6"/>	<input type="text" value="14"/>	<input type="text" value="6"/>	<input type="text" value="13"/>
Consultants	<input type="text" value="9"/>	<input type="text" value="3"/>	<input type="text" value="5"/>	<input type="text" value="19"/>
Contractors	<input type="text" value="4"/>	<input type="text" value="14"/>	<input type="text" value="8"/>	<input type="text" value="15"/>

Are there other sources of information and assistance you have found helpful?

Agricultural Press x 7, Neighbours x 2, Health & Safety, Pollute Company, MAFF.....

How many times have you had dealings with the following in respect of pollution control matters in the last 5 years?

MAFF/ADAS

NRA (AW)

\_\_\_\_\_

**May 1992**

Do you find that policing of pollution control legislation by governmental type departments is:

7

Do you consider that press coverage has become biased against the agricultural community with respect to environmental issues?

				In what respect?	
Yes	50	No	5	Possibly	17
Anti-foreign. All in					

Anti farmers, All issues, Factory farms  
Not accurate x 3

Would you consider yourself to be an active environmentalist and does this influence the way you farm?

Yes 42 No 22 In what respect  
Tree plant x 8, Extra care x 3, Grassland

**Do you belong to any environmental or conservation organisation?**

Yes	Which one	No
17	Game C x 4, FWAG x 9, RSPB x 2 .....	44
	BASC x 2	

**Briefly, what environmental action have you taken in the last -**

**2 years .Ponds.5, Trees 9,.Pollution.Schemes 17, Hedges 3.....**

**5 years** ..... Ponds, Trees 5, Pollution Schemes 10, Hedges 8, Wild Area, Less sprays 2, Spinneys 2

Would the possibility of legal action against you for an environment offence seriously concern you?

Yes 62 Reason: 

Publicity	35
Fine	41
Criminal Record	25
Harm environ	3

 No 4

From which source have you learnt most about environmental issues affecting the farming community, which present their viewpoint? Detail title of publication, etc. please.

National newspapers	11
Local newspapers	19
Agricultural journals	62
Television	12
Radio	12
Public presentations	12
Other farmers	22
Agriculture Training Board	1

## Appendix 2

May 1992

Do you find that environmental legislation requiring pollution prevention measures impinges on the viability of your farm?

	Now	Future
Considerably	<input type="checkbox"/> 9	<input type="checkbox"/> 30
Moderately	<input type="checkbox"/> 27	<input type="checkbox"/> 19
Marginally	<input type="checkbox"/> 18	<input type="checkbox"/> 13
Not at all	<input type="checkbox"/> 10	<input type="checkbox"/> 4

What is the minimum level of grant aid that you would consider acceptable in future to carry out pollution control works?

<input type="checkbox"/> 0	<input type="checkbox"/> 20	<input type="checkbox"/> 40	<input type="checkbox"/> 50	<input type="checkbox"/> 60	<input type="checkbox"/> 80	<input type="checkbox"/> 100	(%)
4	2	2	27	15	4	7	

Has the introduction of the 'Silage Slurry and Agricultural Fuel oil Regulations' affected you in any way?

Yes ☐ 25 In what way?  
 Cost 11 Move oil & bund 5 No ☐ 34 Unaware ☐ 5  
 Construct 2 Reduce silage 1

Have you constructed a farm effluent scheme in the last 8 years?

Yes ☐ 28 No ☐ 18 Not live-stock farmer ☐ 17

What was the factor that initiated the work?

Awareness of problem	<input type="checkbox"/> 30	Lagoon	<input type="checkbox"/> 17
Local complaints	<input type="checkbox"/> 2	Effluent irrigator	<input type="checkbox"/> 10
NRA (AW) complaint	<input type="checkbox"/> 12	Redrainage work etc.	<input type="checkbox"/> 10
Expansion of farm	<input type="checkbox"/> 7		

Labour saving 1

Is there a need for pollution prevention works to be undertaken on your farm in the near future?

Yes ☐ 11 Possibly ☐ 25 No ☐ 32

Please tick the category of size most applicable to your farm (all acres)

<input type="checkbox"/> Less than 50	<input type="checkbox"/> 50-200	<input type="checkbox"/> 200-500	<input type="checkbox"/> 500-1500	<input type="checkbox"/> Great than 1500
5	16	22	20	1

Please give a simple breakdown of your farm type as follows:

Dairy ☐ 13 Beef ☐ 18 Piggery ☐ 27 Poultry ☐ 6 Arable ☐ 56 1 farm c several

Please write any additional comments on the subject of environmental regulation in the space below or on a separate sheet.

Thanking you very much for your assistance and time in this matter.

## Appendix 3

Nov. 1992

1st November 1992

### The Impact and Effects of Environmental Controls

- 1a Have you consulted the following organisations in respect of pollution control matters in the last five years?

HAFF/ADAS (No of Consultations)

50

No. of nil consultations

27

NRA (AW) (No of visits)

16

27

- 1b What factor initiated your contact with them?

EC law x 2, New UK law x 3, Pollution x 9

- 2a Do you find that articles in your agricultural magazines provide you with important information on new legislation and regulations?

Frequently	Often	Sometimes	Occasionally	Never
14	17	20	4	

- 2b Which agricultural magazine/journal do you read the most and for how many hours a week?

AF	FW	FN	BF	hours	1	2	3	5
5	40	18	4		16	17	4	3

- 3 Rate the following groups for your respect for their opinions on environmental matters?

	Neighbours	Government	Family	FWAG	Colleges	TV/Radio	Agric Press
Totally	2	2	6	6	2	1	4
Considerably	13	15	28	13	15	4	30
Moderately	20	30	11	11	15	15	16
Negligibly	11	3	5	3	7	15	2
Not at all	2	5	3	4	6	13	2

- 4a What environmental organisations do you belong to?

WF x 1, RSPB x 1, CIA x 4, NEU x 2, GC x 2, CBE x 1, FWAG x 8, ROE x 1, NWT x 3, BASC x 1, Greenpeace x 1

- 4b Have the environmental organisations that you may belong to, assisted with advice, help and information?

Frequently	Often	Sometimes	Occasionally	Never
	2	7	9	7

## Appendix 3

Nov. 1992

- 2 -

- 5 When considering the effects of pollution on our rivers, which one of these pollutants is the most harmful?

Silage	Sewage	Milk	Oil	Slurry

(Number in priority order with 1 for most, and 5 for least harmful)

- 6 Do you believe that levels of pollution in rivers in your vicinity have altered in the last ten years?

Deteriorated	12	No change	23	Improved	22
--------------	----	-----------	----	----------	----

- 7 What category of farm size (acres) is appropriate to you?

Less than 50	50-200	200-500	500-2000	Greater than 2000
7	17	11	21	3

- 8 Do you believe that new environmental legislation affecting farmers will lead to improvements in river water quality for this Country?

Definitely	Possibly	Unlikely	Only in specific regions
14	26	5	13

- 9a What approximate percentage of your annual farm turnover do you currently put into pollution control works?

% 0 -1 -2

- 9b What percentage of annual turnover do you anticipate you will be spending in on pollution control in approximately five years' time?

% 0 -5

- 10 Do you anticipate that mandatory pollution control work will in future make livestock/animal farming uneconomic for you?

Definitely	Possibly	Unlikely	Unaffected
8	26	14	4

- 11a When considering pollution work what has been the principal factor that has caused you to consider it?

General awareness of problem	30
Desire to comply with the law	27
NRA Requirement	12

Local complaints	
Modernisation or expansion of existing farm	
Necessity to obtain grant	

## Appendix 3

Nov. 1992

- 3 -

- 11b When did you last undertake pollution alleviation work on your farm?  
Year 87 88 89 90 91 92 93  
          2 2 8 4 5 13 2
- 12 What is the minimum storage required for farm effluent/slurry under the Silage Slurry and Agricultural Fuel Oil Regulations?  
Months Storage Months 2 3 4 6 9 12 Dont know  
                  No 10 10 6 1 1 13
- 13 List below your sources of information in respect of farm effluent pollution control matters.  
ADAS/MAFF - 22, Press - 17, NRA - 6, Consultant - 3  
NFU - 3, Neighbour - 2, FWAG - 1, MMB - 1,  
Training Board - 1, Pig F Officer - 1, Manufacturer - 1, Seminars - 1
- 14 Do you consider yourself to be an active environmentalist?  

Yes	36	No	23
-----	----	----	----
- 15 Any additional comments you wish to make.

## Appendix 4

### Statutory criteria for farm effluent storage systems

A facility for storing slurry should be designed to collect and hold slurry safely for a specific length of time. A guide to designing and building slurry storage tanks is given in British Standard (BS) 5502: Part 50: 1989. Design details are given in the Construction Industry Research and Information Association (CIRIA) Report No 126 *'Farm Waste Storage - Guidelines on Construction'*.

Under the Control of Pollution (Silage, Slurry and Agricultural Fuel Oil) Regulations 1991 slurry must be kept in a reception pit or slurry storage tank, unless it is kept temporarily in a tanker. The slurry storage tank includes a lagoon, pit or above ground circular store used for the storage of slurry. The Regulations lay down certain rules for most new, substantially enlarged or substantially reconstructed stores, reception pits and channels, which include:

- No part of the storage facility can be within 10 metres of a watercourse or field drain that the slurry could go into if it escaped.
- Floors must not let liquid pass through, ie, they must be impermeable.
- The base and walls must be protected against corrosion as in BS 5502: Part 50: 1989.
- If the walls of the store let liquid pass through, the base must go beyond the walls and have collection channels draining into a tank.
- The walls and floors must be able to stand up to the loads in BS 5502: Part 50: 1989.
- The storage tank must have a life of at least 20 years if it is maintained properly.
- Reception pits must be able to hold at least 2 days slurry production.
- The storage tank must be big enough to hold at least 4 months slurry unless you have a safe year-round disposal system.
- The size of the store must take into account any rain that falls directly onto or drains into the store while the slurry is being stored.
- The local NRA office must be told in writing at least 14 days before you use such facilities.

Stores that you already have do not have to meet these standards, but the NRA can require improvements if there is a significant risk of causing pollution.

The store should be arranged so that the contents can be easily emptied for spreading without spilling them.

Slurry stores should be designed and built by people who are competent to do these jobs. To avoid pollution, more than 4 months storage may be needed on some farms.

## APPENDIX 5

### November 1992 questionnaire comments by farmers:-

#### Economic

1. "Now however economic's dictate that stock is kept in large concentrations on a few farms only and I have great sympathy for the operators problems".

2. "Profits from most livestock enterprises are minimal. Increased government grants for pollution control will be needed to keep many producers in business".

3. "I would just like to tell you what I think about these new laws. My cousin has been looking after and milking cows for over 30 years. He has now had to give up and sell his cows as he cannot afford to put a lagoon in for effluent. His farm is a very clean place - not near a river etc where effluent cover to drain too. So now due to new rules and regulations re EC he had no regular income from his milk cheque. So many farms like this - it is very sad. We do not have the same problem here as we are not a dairy farm. We have cattle but their effluent isn't in one place - we work all hours here - cannot afford to employ help we need - only one casual worker. My husband works from dawn to dusk looking after his cattle. We have no money to change the way of this farm either re drainage. So I guess if it gets any harder for farmers, we will have to give up too!" Written by a "lady" farmer.

"This industry is chaotic. Everyone likes to see the job done well and tidily but increasing pressure on margins, and the low return on capital in moderate



to high risk enterprises is breaking all our hearts.

I have farmed well for 25 years on a patch that has been in the family's control for 100+. Never have I been more frustrated, unsure, insecure, uncertain. Survival is priority over everything, if we can not get a living, nothing else matters or gets done".

4. "Disposal of dairy herd because of likelihood of increased legislation and necessity to spend lots of money to stay in business. I agree with the environmental aspects but up to now farming has not been sufficiently profitable to invest large sums towards it, even with grants".

5. "I and the vast majority of other farmers have made great efforts over the last few years to bring our pollution control up to a very high standard despite falling income and the fact that despite the 50% grant available the money we have had to spend does not generate any extra income at all compared with investing in new buildings, milking machinery , etc".

#### Legislature

1. "People who really are experts should have a greater say in legislation than those so called experts with vested interests government or otherwise".

2. "Legislation must be proved to be necessary if it is to be taken seriously, ie, the case for setting the present limit for nitrates has never been proven seriously".

#### Environmental

1. "In my opinion if nitrogen was rationed we would not have so much pollution".

2. My immediate neighbour has a pig unit and I have suffered from his

effluent since 1974. In the last two years a spill from his lagoon has poured down my ditches but no action has been taken in spite of visits from the NRA.

I am an ardent conservationist and feel thoroughly disillusioned".

3. "I do think that some small livestock enterprises would find it difficult to continue unless good grants are available. It is my belief that industry creates more pollution than farming especially chemical recycling plant, brickworks, coalite factories etc near which cattle have fallen sick and died".

4. "Disposal modelled on Swiss pattern in 1959 - Good results".!!

5. "Some of the regulations are so stringent and costly that many businesses are unable to afford them. To construct a lagoon etc for the storage of slurry can cost in the region of £30,000+. Even with a 50% grant this can be a lot of money to find in these times. Therefore the problem is either ignored or alternative unapproved methods are used.

The advisory bodies can only tell you to go by the book. It is easy for them to say construct a lagoon or separate your rainwater from yard water to lessen your problem. But if the pipes and drains are under concrete this is a horrendous task.

Some farmyards could be well over 100 years old, they have expanded, had sheds built and concrete laid in times before pollution came to the fore.

To expect a farmer to put right in a relatively short time, problems that have developed over a hundred years is too much to ask and unrealistic.

I don't know the answer, but to penalise someone, even to the extent of closing them down because of problems not of their own making is surely unfair. A lot more financial help must be forthcoming.

6. "Anglian Water said it might be possible to get backflow from my poultry header tanks into the mains and pollute. Utter balls!. I suspect jobs for the boys contrived by Euro bullsh.. from Brussels!! All this ridiculous nonsense tends to make farming already precarious even less profitable. Might I ask how many farms in France and Italy do you imagine enforce such stupid nonsense".

May 1992 questionnaire comments by farmers:-

Environmental

1. "I have each year in the past 3/4 years had folk round complaining about effluent in a small ditch but as the outfall was clean they left. Now NRA have the power to anticipate trouble. eg, If you go into a pub you will be fined because you might come out steal a car and drive under the influence!

ie, my beef unit and silage pile haven't altered in 30 years and effluent has never got beyond the farm shallow ditch or caused any complaint from the new town 2 miles to the SW - yet the NRA seem to be able to assume that it will.

By the way the NRA man thinks that my cattle would stand out 2 x a day on concrete waiting to be milked and that I have no provision for slurry! - I have 400 head of suckler cows A.Angus who never leave their heavily bedded yards!!"

2. "In 1972 I had a new dairy unit built under a farm amalgamation grant. This included a lagoon for liquid waste of all types with settlement tanks and underground piping. Liquid is spread on fields by small self moved (wire

rope system) irrigators purchased about 1988. Previously by aluminium pipes and rain guns. Sludge from settlement tanks is spread by vacuum tanker and semi solid slurry from kennels with straw litter is spread daily by 'rotaspreader' or heaped when no convenient ground. Probably when silage pit regulations are enforced current silage pits will have to be rebuilt, when slurry spreading is banned in late autumn and early winter a slurry store will have to be built. Also Fuel Oil regulation will cause need for modification".

3. "I find most environmentals and greens very narrow minded. Most of the environmental regulations we now suffer are caused by one or two humbugs".

4. "We were encouraged to put nitrogen fertilisers to increase yield, but were not told it would get down into the water by ADAS, now farmers get blamed".

5. "The greatest problem is with planners. They have no idea of the costs involved of such schemes, and give permission for houses to be built next to existing farms; then the environmental health officers uphold complaints from "urbanised" country dwellers.

Money squandered on setaside and the CAP reforms should be put to better use such as pollution prevention and tree/hedge planting. This is a large subject I have strong opinions about".

6. "Pollution control has been introduced with penal threats of fines but with similarly suggestions of penal costs to put farms right. It has generated a new industry of consultants - not all of which are competent. The NRA have been supportive rather than aggressive. Unfortunately there seems to be

little research going into agricultural waste management that is cost effective. There is a fear that the stringent Dutch regulations are going to keep coming this way increasing capital spending requirements in areas which may only have a cosmetic effect (eg covering in muck hills). There is also the fear of the location of Nitrate Sensitive Areas and possibly the feeling that although nitrate + drought cause algal growth problems - the actual health risk was over emphasised. Therefore establishing feeling of mistrust in those acting as experts at advising political decision makers.

The influence of Brussels is not always welcome because often it seems that decisions are remote and poorly thought out for all member states.

Effluent is treatable and controllable but in my view, as a farmer living close to a residential area - smell is going to be the problem of the future. The code of practice is an alarming document and there are very few answers to how one controls smell.

Because I consider this subject a bug of mine, I would be willing to answer further questions should this be of any use".

7. "I feel a lot of money may be wasted as the slurry/dirty water has to be returned to the land from which it will eventually return to the drains and watercourses".

### Legislature

1. "Environmental regulation may be necessary but the necessary work to meet requirements is far too costly for agriculture to meet at this time - A neighbour has been forced out of production (milk) because the slurry system required work cost £25,000. The pressure is on agriculture yet household

pollution goes on unchecked all over the place".

2. "Some indication of what we are actually polluting without the immediate threat of prosecution would help".

3. "Official regulating bodies inspectors should talk to farmers first about the problem and try and reason with them about the problem rather than just go straight ahead and prosecute for pollution offenses. I am sure farmers would be more co-operative if this action was adopted. Fair enough if the farmer is not amiable about the problem then more persuasive action should be taken".

4. "Environmental regulations are necessary but the latest legislation is impractical in a lot of cases".

5. "Laws being enforced very unfairly. NRA scared of big polluters only go for small farmers and will not respond to even reported cases of big problems".

6. "Until recently it was a recommendation that dirty water went down the ditch, and now the powers to be have now found that it was wrong to do this and are now advising other methods of disposal of dirty water".

7. "We accept the farming industry has to be responsible. But the approach of the authorities is very poor and indeed on a personal level NRA and other officials need training in personal skills to improve their approach to the farming community to build bridges, work together to get the whole area improved. The current confrontational checking behind the farmer's back style is not the way to make progress.

8. The NRA sometimes prosecute without warning when a farm has been

operating in exactly the same way for years. For instance we were prosecuted for runoff of a muck pad which had been Ministry approved and unchanged from when it was built 20 years previously".

### Economic

1. "why pay subsidies on a slurry system, it is supposed to be more efficient than a straw muck system and is less environmentally friendly".

2. "The amount of grant aid is of no use if, as in my case you cannot claim grant, because grant will not be paid if you increase production with milk being monitored by MAFF. We have to increase production to remain a viable business".

3. "NRA samples reveal our farm "effluent" where it reaches the marsh dyke is of a high quality (fit for salmon and Trout!) yet because our effluent passes through ditches on the farm we can be prosecuted! To stay in business we will pump all our effluent into our "lagoon". If we apply for grant we feel many impediments will be put in our way and extra expenditure required, so we will not apply. We feel the main need is to provide a practical grant so that our increased overheads do not increase the competition in advantage of continental producers. If our steps do not eventually satisfy NRA we will go out of business!

A drain on our farm boundary contains water not fit for any life (so NRA say). This takes effluent from local sewerage works - NRA take no action about that so why us".

October 1991 questionnaire comments by farmers:-

Media

1. Newspapers, television and radio all issue distorted and violently biased information through apparent ignorance of the subject.

Environmental

1. "I recognise a vast gulf between those who believe the countryside is a poisoned pit of profit for unscrupulous farmers (many of these are journalists) and farmers, with countrymen who know about the legally enforced control of hazardous substances and many other compulsory and voluntary efforts make for a less polluted world".
2. "I feel that pollution is not just a matter for farmers - but where farms do try to cut down on artificial fertilizers and replace it with manure just as many complaints are made by the local community - it would seem that we just cant win".
3. "You should understand that we are the environment".
4. "I have a small farm 60 acres with 50 cows and fallowers. Luckily it is on light land which soaks up any problems I have. Where it goes I have no idea, but the waterboard inspector when asked said - I can not see any problem - is that an adequate statement??"
5. "The present gearing of my business leaves little or no margin for expenditure on non-money earning activities. I consider the purchase of a new spanner an expense that I have to justify. Pollution control measures do not improve my profitability or help me to justify my labour expenses, yet I am desperately keen to keep improving control measures. However I am



proud to say that my 2000 pigs result in no pollution of the local brook, unlike my two neighbouring villages of Burstall and Elmsett which have numerous septic outfalls direct into the stream and a treatment plant that seems to get overloaded. As a result the NRA have told me that in the summer months the brook is clinically dead".

6. "Obvious pollution from stock units, slurry or silage and spillages from chemicals and fuel oil etc have to be controlled and I agree with this. Other pollutions!? Nitrates, dust, smell and noise I would be much less happy about partly that they are not proven in many cases as being dangerous and partly that a sanitised countryside would not be the same especially where smells are concerned".

NB - Quotes are as given and may therefore be in poor English.

## APPENDIX 6

### Revision of training procedures

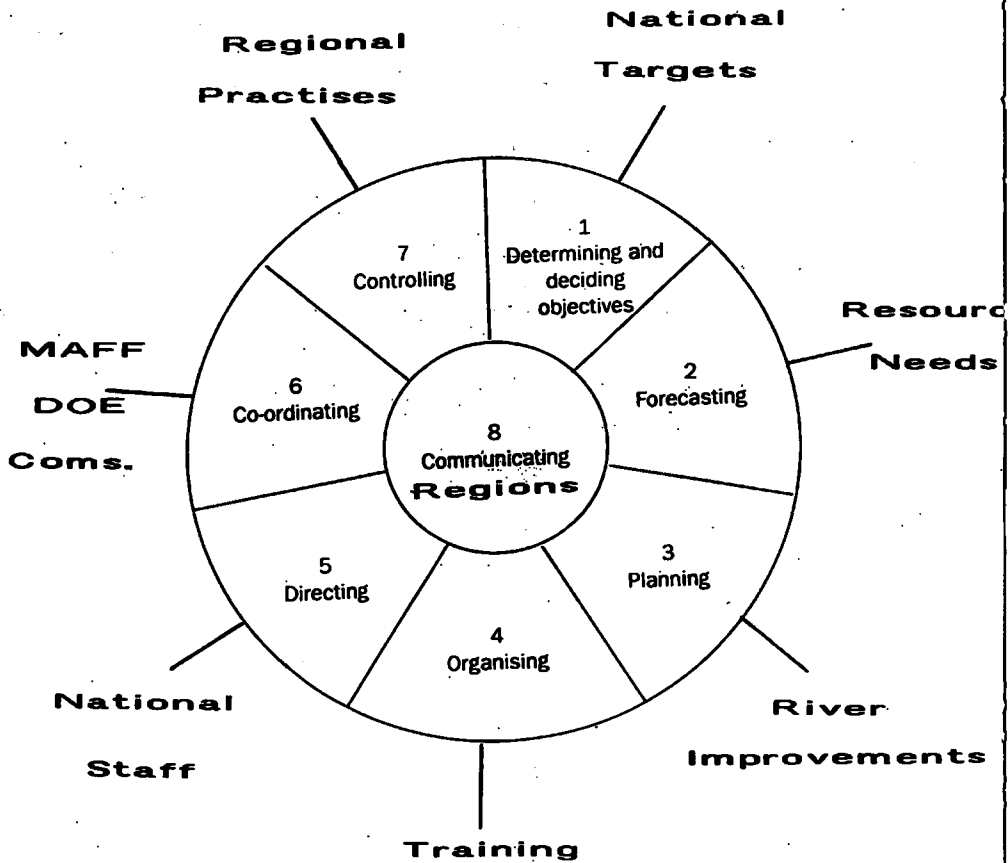
The magnitude of problems associated with agricultural pollution in rural England and Wales results in organisations such as MAFF and NRA putting considerable resources into this area of work. No formal training exists for staff involved in this field work, and most learn on the basis of pairing with an experienced officer for a short while. Whilst without doubt many experienced officers are undertaking duties in a professional and capable manner, the training of junior staff is not undertaken in any professional way. The complexity of farm pollution regulations, the need for NRA grant aid inspections and the requests for advice, all lead to a necessity for greater skills and knowledge, than that required even a decade ago. If consistency of approach and high standards are to be achieved a formal training structure is urgently required.

Criticism of some NRA disparity in implementation of standards has been shown in my surveys. NRA officers dealing with industry will on occasions take a year long course leading to a diploma in Integrated Pollution Control.

A proposed solution would be the adoption of a joint venture with an existing agricultural college to provide formal training (perhaps a week residential). The training would be theoretically self financing, since NRA experienced staff would provide some of the lectures and the college the remainder, with an appropriate academic qualification after examination. Since no similar

**Figure 33**

**Management of Pollution Control**



course exists in UK, marketing and financing would be achieved for the two partners, by fees from external students. Markets exists for training with - farm managers, land agents, farmers, MAFF and ADAS staff, and agricultural consultants. Fees from these sectors would then be used to subsidise the numbers of NRA water quality staff undertaking the course on a compulsory basis. The additional benefit would be the cross-fertilisation of concepts and needs, to other agricultural colleges. The intention would be to use a "premier" agricultural college ie Silsoe as the NRA's partner, with the course containing a mixture of theory and practical demonstrations. When a substantial number of NRA and MAFF staff had gained the "Agricultural Environmental Certificate", staff would then only be permitted to work unaided on farm problems, after completing the course. The additional benefit to the wider agricultural community might be that farm waste matters would be included in the syllabus of most agricultural colleges. My studies have shown this to be a neglected area within most current agricultural courses.

A number of other minor training revisions, could be the holding of regular national and regional seminars to update knowledge and ideas.

#### Revised management structures

To implement the measures detailed, the organisations involved will need new management structures, lines of communications and areas of responsibility.

Separation of those new functions from existing duties, such as enforcement and prosecution is needed, if it is to be seen as a initiative to work in partnership with farmers.

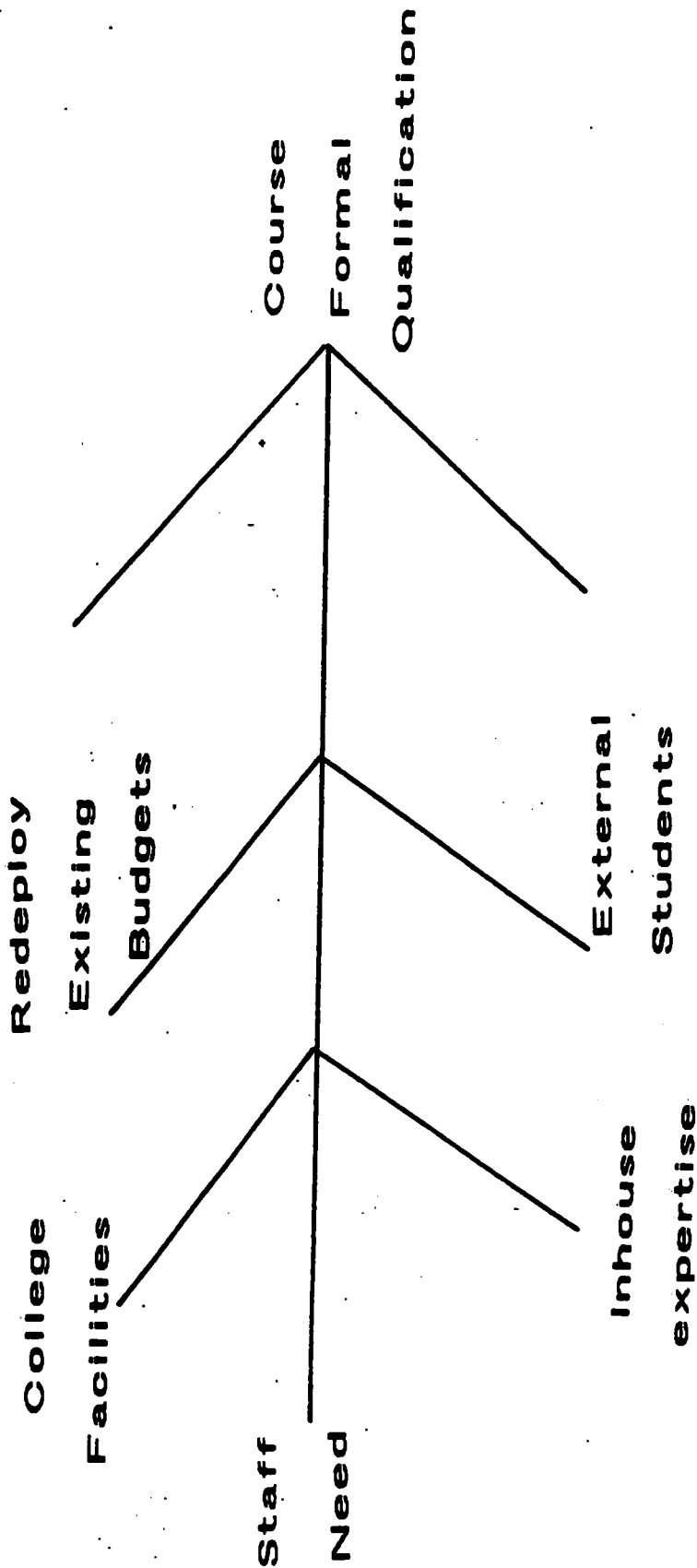
Figure 33 shows a potential management linked structure for a pollution prevention manager using the principle of Fayols wheel of managerial activities. It can be seen that such a manager will be an office based team head, who will control and allocate resources in his team in order that the nationally defined targets and deadlines are achieved.

Staffing for the new structures will be achieved using existing water quality scientists, after the appropriate training as detailed. Since the existing staff already undertake these duties on a random unstructured basis, the redeployment of a small number of them to the new section should be accommodated within current staffing levels.

Nationally there is a need for a small number of posts to ensure national consistency in regions, by use of occasional audits. The national team would also form the basis of the integrated team urgently required, as detailed with MAFF, ADAS and DoE.

#### Financial Implications

The majority of the improvements and revised structures detailed do not incur significant additional financing, but more effective redeployment of existing



**Figure 34**

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resources. This will apply to improving information flows, holistic approaches, and catchment studies.

NRA currently has considerable budgets for pollution prevention work, and it can be argued that most essential pollution prevention equipment has been purchased in the last five years. The proposal is therefore to reallocate a substantial part of that budget into setting up a training regime with a college. Figure 34 and Table 18 shows the process that will be undertaken to demonstrate the business case for setting up this training. It is difficult to quantify costs involved, but estimations are set out below. It can also be argued that a wider cost benefit, will eventually be achieved, since farmers will affect better effluent pollution control, and rivers will consequently be cleaner.

**Table 18**

**Hypothetical Proposed Agricultural Course, Training Budget/Year**

Expenditure		Income	
NRA (50) staff trained (£400 each- no profit)	120,000	(100) External students (£800 each - includes profit element)	480,000
Administrative Resources (shared with college)	15,000	Note - proposal is for 6 x 1 year course/year	
Buildings upkeep (existing college)	12,000		
(4) Tutors (Shared)	40,000		
<b>Total</b>	<b>295,000</b>	<b>Total</b>	<b>480,000</b>

deadlines and review dates. At the end of year two it is suggested that objectives and financial targets for the training enterprise should have been achieved.



### Marketing and promotion

It is proposed that "training" marketing would be prepared jointly by the college, ie inclusion in prospectus, and by pro-active advertising in journals such as Farmers Weekly. Mail shots would be sent to farmers, consultants and managers etc. Prior to reaching this stage it would be appropriate to test the actual demand for such training, by approaching a trial section of potential students. It should be noted that even in the event of an insufficient demands for external students, a course for governmental officers will generate sufficient students. Figure 35 illustrates the factors involved.

The structure for promoting and running the course would be divorced from routine NRA work, by the formation of an IBU, manned on a part-time basis, by field water quality officers.

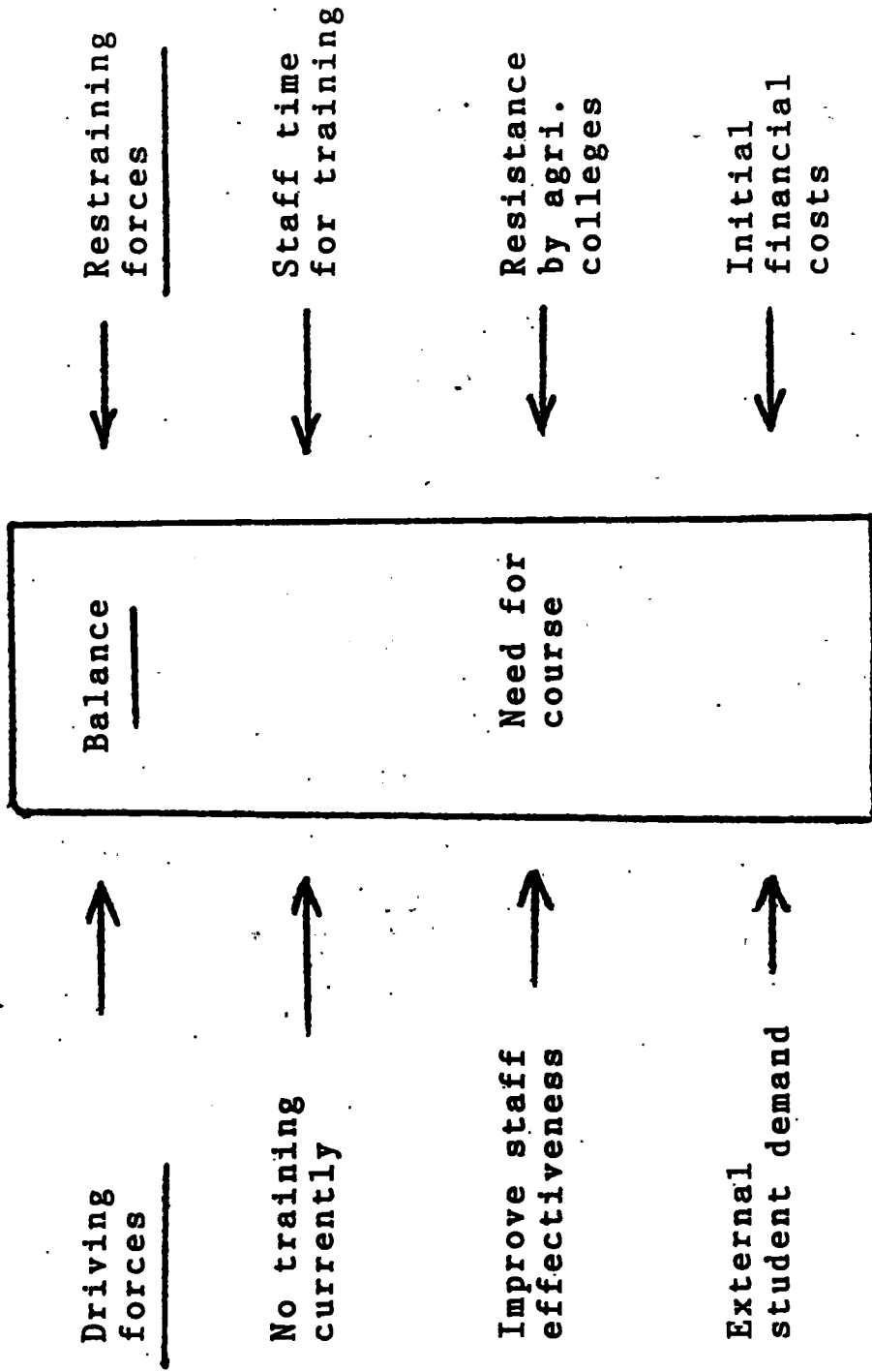
### National implementation and review procedures

The NRA nationally has many experienced water quality officers and it would be appropriate to bring them together, on a part-time basis to create a centre of excellence, that would form the basis of implementing these changes detailed. In parallel with this group, other organisations would be integrated in the new approach as appropriate ie MAFF, DoE and Silsoe. (See Fig 36).

The national centre would have as its main duties, to set objectives, targets,

Figure 35

Marketing needs for training



**Figure 36**

**Proposed NRA National Agricultural Centre**

